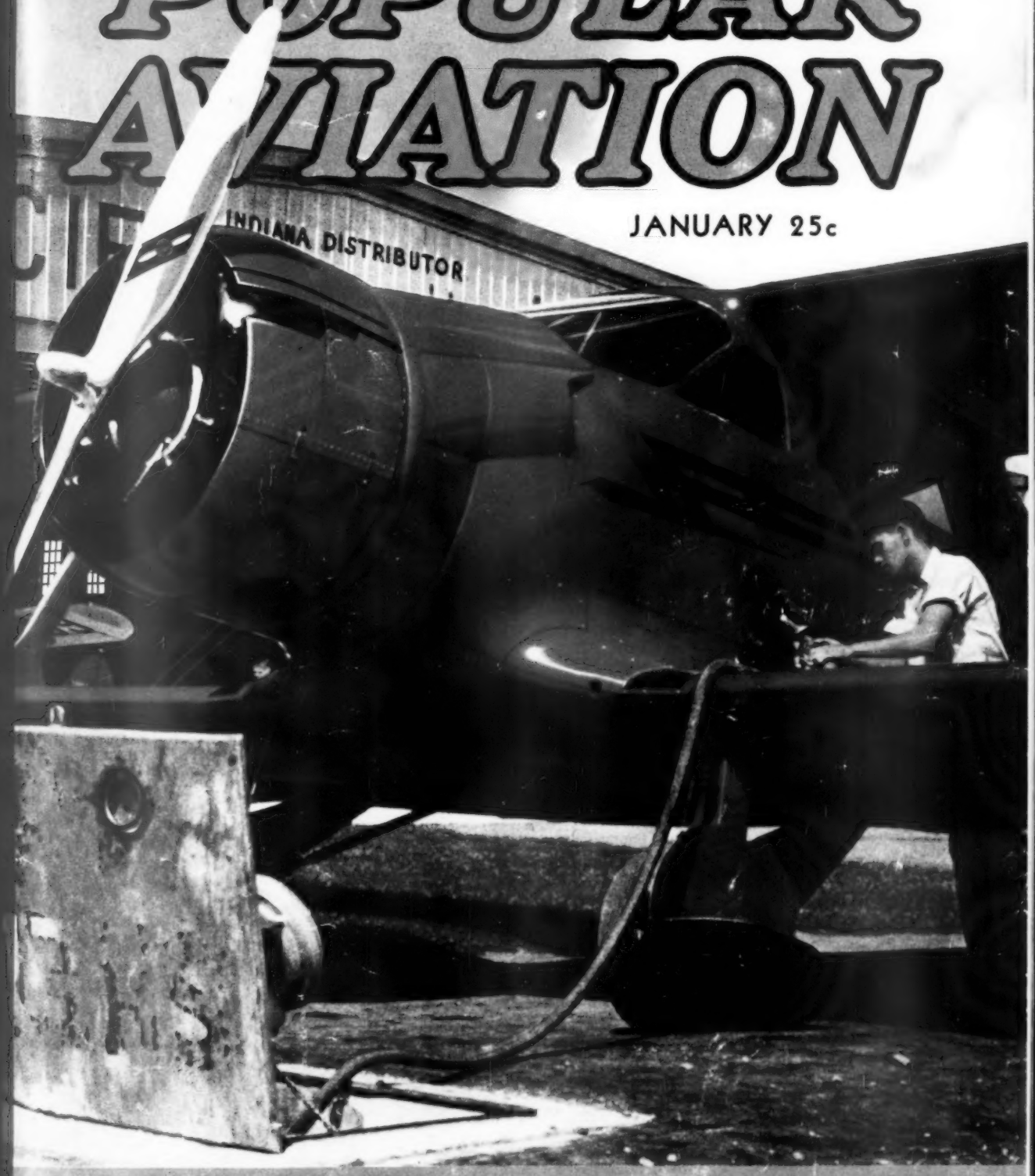
IE GERMAN AIR FARCE .... SEE PAGE 10

POPULAR AVIATION

JANUARY 25c



UR AIRLINES ARE *SAFE* by MAJOR R. W. SCHROEDER

AVIATION NEEDS A MODEL "T"

CHOOSE YOUR SCHOOL CAREFULLY

TL501
F4
V-24-25

TRAIN ON THIS MIRACLE AIRPORT IN
AMERICA'S AVIATION CENTER

"For flying, engineering or mechanics . . . this is one of America's greatest aviation schools"

Not only is California Flyers located in America's aviation center, but on the most active and complete airport in America. Here on California Flyers campus is every single phase of aviation activity; designing, building, testing, flying and maintenance. Right on this one field are the factories of America's greatest military planes (the testing field of 55% of the nation's planes) and within a few months it will become the terminus of America's greatest air lines. All of this fits in to California Flyers training policy, that of learning by *doing* and where else is there greater opportunity of *doing*, than right here at this Miracle Airport. The Executive Transport Pilot student learns the exact methods used in the neighboring passenger and maintenance divisions of five of the nations leading air lines. The Aeronautical Engineering student follows the formuli set down by the designers of the neighboring Northrop, North American, Douglas, Lockheed and Vultee plants. He is on the inside of the latest achievements in designs and production. And so it is with every single phase of aviation training, this tremendous aviation activity assures him that he is learning the world's most advanced aviation methods. It is this kind of training that builds aviation careers.

Because California Flyers is a complete flying, engineering and mechanical school located on an airport and maintaining its own fleet of planes, students learn, not alone from the class room, but from working on planes in actual service. Students design and build planes, maintain ships, go step by step through the various phases of activity that comprise the operation, building, planning and maintenance of airplanes. The U. S. Government approved repair shops, the new C Type Link Trainer, instrument maintenance shop, a squadron of modern training planes, a metal fabrication shop; all these are active service divisions. Planes are being planned, real ships, not dummies, are being built, reconditioned, repaired and flown. This, too, is the kind of training that builds aviation careers.

Compare California Flyers from all other angles. Its instructors, its reputation, its record, its equipment, its atmosphere and you will find, as have hundreds of others, that here is America's outstanding aviation school. Compare living conditions and living costs here in sunny Southern California. Compare all these and you'll see for yourself how obvious it is that California Flyers is the place to start your aviation career.

Write today and get the complete story of this intensely interesting field of aviation and of the school that is playing such a vital part in the building of the careers of tomorrow's aviation leaders and executives. Simply fill out the coupon. (No salesman will call.)

HIGHEST U. S. GOVERNMENT APPROVAL

CALIFORNIA FLYERS, INC.

SCHOOL OF AVIATION

LOS ANGELES MUNICIPAL AIRPORT, INGLEWOOD, CALIFORNIA

SEND FOR CALIFORNIA FLYERS INTERESTING CATALOG TODAY

CALIFORNIA FLYERS, INC.
School of Aviation, Dept. PA-1
Los Angeles Municipal Airport, Inglewood, Calif.

Please send me your new FREE catalog. I am interested in subjects checked

Flying ☐	*Aircraft Building (Aircraft sheet metal)* ☐	
Mechanics ☐	*Aeronautical Engineering and Design* ☐	
Instrument Flying ☐	*Drafting* ☐	*Instrument Technician* ☐

Name _____ Age _____

Address _____

City _____ State _____

THE ONLY FLYING-MECHANICAL SCHOOL IN THE NATION'S AIRCRAFT CAPITAL

DEC 17 1951
EMORY UNIVERSITY, GA.

As a PARKS Trained Aeronautical Engineer you'll be well fitted to Go Forward with Aviation

Your Training in the Aeronautical Engineering Course Includes:

● 992 hours of basic courses including Mathematics through Integral Calculus, Physics and Applied Mechanics.

● 1356 hours of manipulative and informational courses including 300 hours of aeronautical engineering drawing, 1124 hours of practical work in Sheet Metal, Metal Fittings, Welding, Fabric, Finishing, Instrument, Propeller and Engine Departments and 20 hours of Flight Training.

● 780 hours of applied courses including Machine Design, Industrial Engineering, Aerodynamics, Engine and Propeller Design, Stressed Skin Construction, and 540 hours of Airplane Design.

● 394 hours of background courses including Air Transportation, Flight Engineering, Meteorology, Navigation, Air Commerce Regulations, Business Law, Writing, Speaking.

PARKS course in aeronautical engineering offers you well rounded training which includes basic, manipulative, applied and background subjects. Its purpose is to provide training so comprehensive that you will be qualified to advance to positions of leadership in any one of the several fields open to the aeronautical engineer.

An effective balance between the theoretical and the practical in training is carefully maintained — increasing the value of both phases to you. The training is of true college rank in every respect, complete and thorough in every subject.

The aeronautical engineer has the greatest opportunity to share in the progress of the aviation industry. Your training at Parks equips you to contribute to the development of aviation — to be a constructive figure in its progress. 92 of the 309 students studying at Parks Air College are registered in the Aeronautical Engineering School.

Other Parks courses of equally high rank and equally thorough in scope include the Professional Flight and Executive Course, the Aviation Operations and Executive Course and the Maintenance Engineering Course.

If you desire a successful career in commercial aviation it will pay you to send for complete information about Parks Air College. The coupon brings you Parks 60-page catalog and bulletin. Both are free.

In common with all of commercial aviation this is the code of Parks Air College, "No compromise with safety will ever be permitted or excused."

PARKS AIR COLLEGE

East St. Louis, Illinois

Control Tower — St. Louis Municipal Airport

PARKS AIR COLLEGE
East St. Louis, Illinois Section 1-PA

Please send me details of Parks four major courses in commercial aviation training.

Name.....

Address..... Age.....

City.....

State.....

Fully approved by the Civil Aeronautics Authority, Accredited by the Illinois State Superintendent of Public Instruction.

CHRISTMAS GIFTS
for PARTICULAR Model Builders

Here are some swell gift suggestions for your air-minded friends who make gas model building their hobby. A gift for every purse, and each a gift you'll be proud to give. Every kit is "Custom Built" and guaranteed to win the approval of every particular model builder. Avoid the rush! Order now!

THE HAWK

Here's an exceptionally fine miniature gas model that's easy to build and flies like a charm. It has a gigantic wing span of 48". Kit is complete, except for colored dopes, and contains all of the latest improvements. A truly fine and inexpensive gift. **$3.95**

IT'S WISE TO BUY A-P KITS—YOU GET ONLY THE FINEST GRADE OF MATERIALS—EACH KIT IS COMPLETE IN EVERY DETAIL—FULL SIZE BLUE PRINTS ELIMINATE THE POSSIBILITY OF ERRORS IN CONSTRUCTION. THESE EASY-TO-BUILD KITS CAN BE ASSEMBLED INTO RECORD-BREAKING MODELS WHICH HAVE BIG PLANE PERFORMANCE.

TAKE A LOOK AT THESE WINNERS—Order One Today!

ART CHESTER'S JEEP
This dandy has been approved by Art. Chester and is 56½" long with a wing span of 71½". It's actually an ideal flying gas model of Art's classy racer in cream with dark green trim. Complete kit.... **$12.00**

New TAYLOR CUB
This sensational flyer is 50" long and has a wing span of 79½". It's a beauty in yellow and black. Complete kit..... **$8.50**

REARWIN SPEEDSTER
Here's a contest winning, nationwide favorite which has been approved by thousands. It's 3'6" long and has a wing span of 6'. Colored in rich appearing red and silver combination **$8.50**

STINSON RELIANT
It must be good if the Stinson Aircraft Corp. gave it its approval! 53" long, with a wing span of 6' 11¾". A real winner with plenty of wing surface to make it glide in slowly..... **$14.50**

U. S. ARMY PURSUIT
A 48" long knobby, stable and consistent flyer in blue, with army yellow wings having a span of 57". Kit contains colored army insignia..... **$8.00**

SILVER FLYER
This trim, single seater pursuit job is 3' 6" long and has a wing span of 6'. And, what performance! Kit complete with balsa air wheels, **$6.50**

U. S. NAVY RACER
Trim, sleek, stable flyer of the late Capt. Page, famous racer. 52" long with a wing span of 72". Regulation Navy Blue and Orange.. **$10.00**

HOWARD D. G. A. 8
Benny Howard gave this kit his okay. Its 51" of length and wing span of 6' 4" makes it a great model of a famous flyer. The harmonizing orange and black makes it a beauty! **$12.50**

MONOCOUPE 90-A
A knockout! Length, 50"—Wing span, 76". Rich blue, trimmed in silver, and flies like a million. You'll be proud to own it..... **$12.50**

IMPORTANT NOTE!
These kits are ABSOLUTELY COMPLETE, except for motor. Get any one of them and eliminate the necessity of having to buy a lot of extra parts. Each kit contains: all movable controls; ready formed landing gear and motor mount; spun alum. cowl—where necessary; new type, streamline, puncture-proof, rubber tired wheels; FULL SIZE BLUE PRINTS; license numbers and authentic markings; sheet aluminum; semi-finished wheel pants on models where necessary; leading and trailing edges tapered to shape on tapered wing models; all liquids (including colors); switches, bolts, screws, etc., and the majority of curved parts cut to shape; such as ribs, forms, wing-tips, etc. Such completeness will enable you to build a *finer* gas model.

FILL OUT THIS COUPON TODAY!
AVIATION PRODUCTS CO.
619 S. Federal St., Dept. L-17
Chicago, Illinois
Please rush the following kits to me today!
(check kits desired)

ART CHESTER'S JEEP	☐	U. S. NAVY RACER	☐
HOWARD D.G.A.-8	☐	STINSON RELIANT	☐
REARWIN SPEEDSTER	☐	SILVER FLYER	☐
MONOCOUPE 90-A	☐	U. S. ARMY PURSUIT	☐
THE HAWK	☐	NEW TAYLOR CUB	☐

I enclose $.....as payment in full.
☐ Enclosed $1.00 deposit. Balance C.O.D. plus slight postage charges.
NAME .....
ADDRESS .....
CITY & STATE.....
Note: West of Mississippi, and Canada, add 10%. Foreign 15%. Add 50c to cover mailing costs on each kit.

POPULAR AVIATION, Vol. XXIV, No. 1, January, 1939. Published monthly by Ziff-Davis Publishing Company, at 608 S. Dearborn St., Chicago, Ill., U. S. A. Subscription $2.50 per year, single copies 25 cents; foreign postage $1.00 per year extra, except Canada. Entered as second class matter, January 24, 1933, at the Post Office, Chicago, Illinois, under the act of March 3, 1879.

After a two-year study of the Aviation Industry, Dr. Carl Norcross, Member of the New York State Department of Education, and of the Institute of Aeronautical Sciences, predicts, in his latest book, "GETTING A JOB IN AVIATION," that there will be

37,000 PEOPLE NEEDED FOR JOBS IN AVIATION IN THE NEXT 5 YEARS

Dr. Norcross predicts that in the air-line branch of aeronautics there will be an increase in personnel of between 12% and 15% each year for the next five years. This increase will practically double the number of present employees in this one branch of aviation.

Aviation factories, now the largest single division of aeronautics, at present employ about 40,000 people. Dr. Norcross sees this number increased to approximately 64,000 by the end of 1943.

In "GETTING A JOB IN AVIATION," Dr. Norcross states: "Aviation is definitely the number one vocation in popularity. But despite the thousands of young men who are knocking at aviation's gates, employment managers of air-lines, factories and airports are having real difficulty in finding the kind of men they are looking for. Higher personnel standards exist in aviation than in almost any other kind of work. Factory employees in aircraft and engine plants work to precision tolerances that are unheard of in other industries. Air-line personnel, from pilots on down to men who polish the outsides of airplanes, is chosen with meticulous care. Mechanics who service private airplanes may present the greasy appearance of garage mechanics, but the aircraft workers have such responsible jobs that they must have completed an exacting course of training and have passed difficult tests set up by the Federal Government."

Aviation is now so specialized, states Dr. Norcross, that it is practically imperative for a young man to *secure special training* before he is able to get a job.

ROOSEVELT AVIATION SCHOOL

the Oldest Government Approved School in the East, has been giving the "specialized training" referred to by Dr. Norcross for twelve years. In that time this institution has always turned out men properly trained to meet the strict requirements of the industry. That is why Roosevelt graduates are making good in every branch of aviation

AVIATION TRAINING AT ITS BEST

WINTER CLASSES START JANUARY 3, 1939

ROOSEVELT AVIATION SCHOOL—at Roosevelt Field, Mineola, Long Island, N. Y.

Without obligating me, send details of course checked:

☐ SOLO PILOT ☐ COMMERCIAL PILOT ☐ LIMITED COMMERCIAL PILOT
☐ PRIVATE PILOT ☐ AIRCRAFT SHEET METAL ☐ AIRLINE TECHNICIAN
☐ MASTER AIRPLANE AND ENGINE MECHANIC ☐ MASTER AIRPLANE MECHANIC
☐ AIRCRAFT DESIGN AND CONSTRUCTION ☐ COMBINATION FLIGHT-MECHANIC

SIGN AND MAIL COUPON TODAY

Name..... Age.....

Street Address..... Town..... State.....

P. A. January, 1939

THANKS

to the Aviation Industry

THIS is a "thank you" and a pledge to the aviation industry. Thanks for 16 years of generous co-operation in hiring Ryan recommended graduates. Each succeeding year ever increasing numbers of Ryan trained men take their places with airlines, factories, and commercial operators. That these pilots, mechanics and engineers make good is best attested by your increasing demands for additional Ryan graduates. As America's oldest, yet most modern aeronautical school—and the only certificated school closely affiliated with an aircraft factory—we pledge that our recommendations will continue to be unbiased and based entirely on the student's training record, his personal character, and our opinion of his ability to satisfactorily meet your specifications—thereby maintaining the high standards that have distinguished Ryan men in your ranks.

RYAN

SCHOOL OF AERONAUTICS

LINDBERGH FIELD, SAN DIEGO, CALIFORNIA

FLYING • MECHANICS • ENGINEERING

Dallas Aviation School and Air College

» » World Famous Flying and Mechanics School « «

U. S. Government Approved School

MAJOR W. F. LONG, President **DALLAS, TEXAS** C. E. HARMAN, Secretary-Treasurer

Come Where It Is Comfortable All Winter

Where the weather seldom gets below freezing and everything of the best.
"Where the Summer Spends the Winter"; Avoid Snow, Sleet and Blizzards!

OUR TWELFTH SUCCESSFUL YEAR!

We have just passed our twelfth year milepost in the operation of this school. Each and every year from the beginning we have added to our facilities, shop and flight equipment. All this taken together with $1,000,000.00 worth of airport equipment recently added by the city makes our "spot" one of the best in the United States and in a class by itself.

All-year flying conditions with no layoffs for any reason.

Therefore, we think that a student who selects this school for his training does "the best there is" for his future.

• • • • •

Every student enrolling in our "Good School" is enrolled on exactly the same basis according to the course enrolled for. No special privileges, no special discounts—all may expect to and *will receive* training just alike. This makes for good feeling and good progress from the beginning of your course until you complete it. Every student gets wonderful class room instruction in all subjects, good practical experience in all departments and still has ample time for recreation and pleasure.

You are cordially invited to write for full information about our school and we will mail you, without obligation, our catalog and price list for your comparison with other schools.

• • • • •

We promise you in advance that you will not be disappointed with anything when you get here, but decidedly to the contrary will be true. You need our excellent training and we can assure you it will be worth while for you to COME TO DALLAS.

• • • • •

FLIGHT TRAINING

During the winter months, as well as the balance of the year, we fly practically every day and our students have a greater variety of good, modern aircraft to fly than is owned by any school in the U. S. A. For the reason that we have fine, open winter weather conditions you can finish your course and secure your license in less than half the time than elsewhere at a lower price and be a better pilot than you might otherwise.

• • • • •

MECHANICAL TRAINING

We have five class rooms and eleven shops filled with practically every kind of power machinery and otherwise for the benefit of and the use of our students throughout their courses. Practical work is always available in rebuilding aircraft, making repairs and servicing aircraft and motors. Your time will be filled abundantly with interesting experiences from every point of view. You cannot miss at this school and you might elsewhere.

• • • • •

BLIND FLYING AND THE LINK TRAINER

We have a special course for blind flight ratings in connection with the Link Trainer and a very fine Wasp Stearman aircraft. We have graduated more than 100 pilots during the past eighteen months who have secured their ratings to fly on airlines and practically all of them are now employed. Pilots come here from all over the United States to get their ratings from us. This special course is included with our MASTER AIRMAN'S COURSE without extra charge.

• • • • •

THIS SCHOOL

. . has a favorable reputation, not only in the U. S. but internationally. We invite you to contact any pilot or airport manager anywhere if you are interested in taking a course in aviation. It will be worth while to do so and you will save yourself a lot of time, money and living expense.

"You Can't Buy More . . Why Pay More?"

DALLAS AVIATION SCHOOL AND AIR COLLEGE

LOVE FIELD DALLAS, TEXAS

DALLAS AVIATION SCHOOL,
DALLAS, TEXAS.

Please send your catalog to:

Name_____ Age_____

Address_____

City_____ State_____

IT IS to be hoped that, during the coming year, as much improvement in safety devices will be made as during the past year of 1938. The aviation industry and the instrument and radio divisions, in particular, have made real advances in safety devices that already have shown a marked decrease in the number of accidents and in the casualties resulting therefrom.

* * *

FOR the past eight years, I have bemoaned the too rapid advance of standardization in an industry that is in its infancy or even pre-natal stage, as one might say. We are attempting standardization before the perfection stage of development has been attained and, sad to say, standardization always stifles progress and radical basic improvements in the design and invention of new equipment. This has been proved repeatedly in the automobile world which only now is profiting by delayed improvements suggested many years ago. Great God Production and his twin brother, Standardization, create back-waters of stagnation.

* * *

JUST as graphic proof of this statement, I refer you to an article appearing in this issue, "Look Alikes." These are only a very few examples taken from our files of ships that are almost identical in design or, if you will have it, styling.

* * *

NEEDLESS to say, the airplane of today is not the airplane that we will know twenty years from now. Even in ten years, new discoveries and inventions will be made that will make the present crop look silly always providing, of course, that this happy day is not delayed by considerations of standardized practice, standardized servicing and investments in tools, dies and jigs. Turning over service station stocks and equipment is a mighty expensive proposition that manufacturers naturally avoid as much as possible.

* * *

FIRE still continues as Aviation Enemy No. 1. Its menace has not been diminished by the construction of all-metal planes because the structure is not the basic source of the trouble. In fact, an all-metal plane, under certain condi-

(*Continued on page* 68)

POPULAR AVIATION

Volume XXIV JANUARY, 1939 Number 1

CONTENTS

FEATURES

The German Air Farce	10
They've Got to Have Rhythm	13
Uncle Sam Looks West	14
I Flew On a Japanese Airline	18
Cupid Gets Streamlined	20
Aviation Needs a 'Model T'	23
Our Airlines Are Safe!	25
I Flew for a Week	27
Plane Lightning (full page photograph)	29
Aviation Jr.	30
Remember the 'Bullet'?	33
Look-Alikes	34
Aviation's Gadgeteers	36
Soar Your Lightplane	40
Airplanes by the Dozen	42
'Tin'-Skinned Airplanes	46
The Man Under the Hood	49
Choose Your School Carefully	50
This "Swing" is Dangerous	52
Wings for the Red Cross	54
Centralized Power for Aircraft?	57
Safety in Spins	59
Personalities	60
The Science of Streamlining	63
This Month's Gas Model	66

Cover Photograph: Beechcraft by William Minor

Copyright, 1938

ZIFF-DAVIS PUBLISHING COMPANY

Editorial Offices: 608 S. Dearborn St., Chicago, Ill.

Member of the Audit Bureau of Circulations.

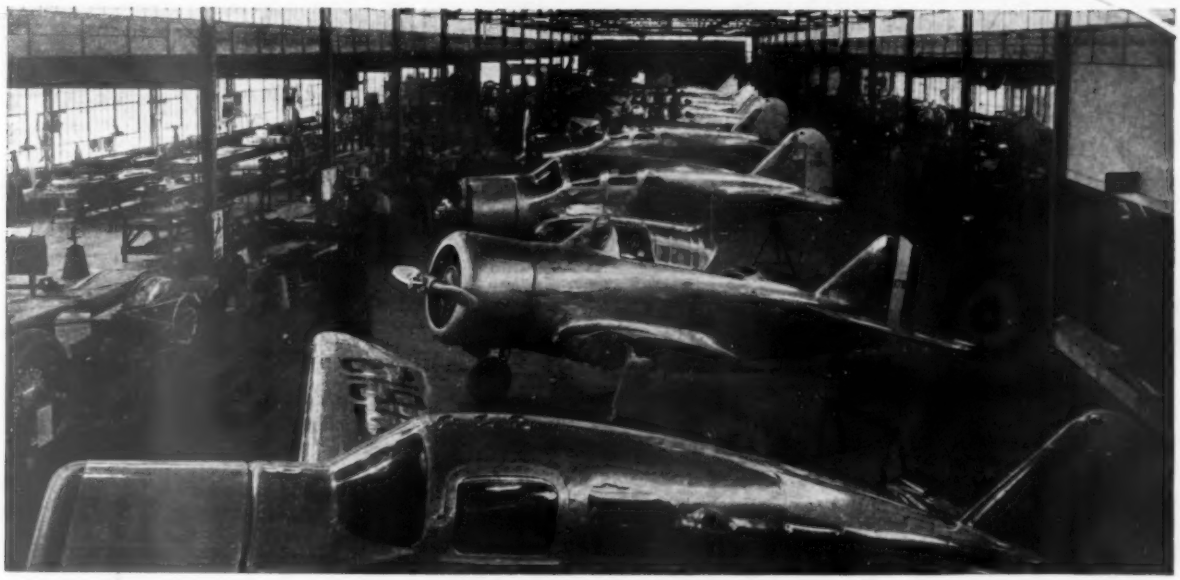
POPULAR AVIATION is published monthly by the Ziff-Davis Publishing Company at 608 S. Dearborn St., Chicago, Ill. William B. Ziff, Publisher; B. G. Davis, Editor; John B. Rathbun, Managing Editor; Max Karant, Associate Editor; A. F. Maple, Advertising Manager. Herman R. Bollin, Art Director. New York Office, 381 Fourth Ave. Subscription $2.50 per year; single copies, 25 cents; foreign postage $1.00 per year additional, except Canada. Contributors should retain a copy of contributions. All submitted material must contain return postage. Contributions will be handled with reasonable care, but this magazine assumes no responsibility for its safety. Accepted material is subject to whatever revisions necessary to meet requirements. Payment will be made at our current rates upon acceptance and, unless otherwise specified by the contributor, all photographs and drawings will be considered as constituting a part of the manuscript in making payment.

Your PLACE IS WITH THE Dawn Patrol

ONLY AT SPARTAN DO YOU HAVE THE FACILITIES OF THIS GREAT FACTORY BUILDING BOTH COMMERCIAL AND MILITARY ALL-METAL AIRPLANES

When you become a member of the DAWN PATROL the most complete facilities of any School of Aviation are at your finger tips. Spartan equipment ranks outstanding in the Nation, two of the largest and most modern hangars in the United States house the finest in flying and mechanical equipment. Close affiliation with the Spartan Aircraft Factory gives YOU knowledge in the manufacturing of all-metal aircraft. The facilities of the Spartan Approved Repair Station No. 50 further increases your knowledge of ALL types of airplanes, engines and equipment.

Members of the DAWN PATROL come from every section of the United States and foreign countries. They will leave Spartan equipped with the training to fit them for positions of leadership in Aviation. A place is waiting for YOU in the DAWN PATROL—*the opportunity for YOUR future in Aviation.*



HOME OF THE DAWN PATROL

Spartan SCHOOL OF AERONAUTICS

GOVERNMENT APPROVED

SPARTAN SCHOOL OF AERONAUTICS, P. O. BOX, 1249, TULSA, OKLAHOMA

GENTLEMEN: Send me a copy of the NEW 1939 SPARTAN Catalog and Supplement describing in detail Spartan Flying, Mechanical and Radio Courses of Aeronautics, Tuition and detailed living expenses

NAME_____

ADDRESS_____

CITY_____ STATE_____

AGE_____ Any Previous Flying Experience?_____

Check below branch of Aeronautics you are most interested in:

- ☐ FLYING
- ☐ MECHANICAL
- ☐ RADIO INSTRUMENT
- ☐ EXECUTIVE-MANAGEMENT

THE GERMAN AIR FARCE

Are such displays of might merely "the rattling of harmless tin cans"?

by LIEUT. A. G. J. WHITEHOUSE

The author, a former member of Britain's Royal Air Force, presents some potent facts concerning Hitler's threats.

DURING the happy days of the World War we used to carry out a screwy little plan wherever salients on our front were particularly weak. It was a silly game, but we all enjoyed it, for it gave us a superior feeling of bluster and not a little comfort.

What we used to do was to occupy a particular chunk of trench that was badly battered, either by shellfire or the rats, and then use a handful of youngsters who were always game for a lark in creating the impression that that particular sector was bulging with half a dozen Guards' regiments.

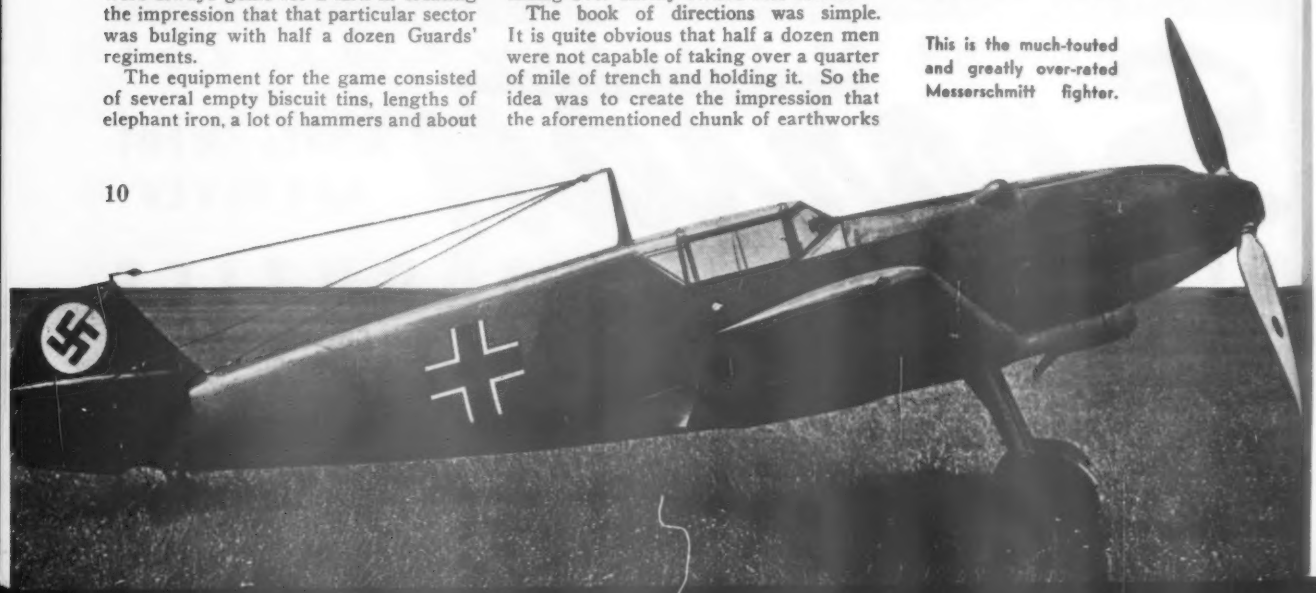
The equipment for the game consisted of several empty biscuit tins, lengths of elephant iron, a lot of hammers and about half a dozen rifles. With that strange conglomeration of ironmongery—plus, as I stated before, half a dozen kids who were not many years removed from the kindergarten, we usually could hold about a quarter of mile of front, which is pretty good holding. I am sure now, looking back on it all, that, had we been given one machine gun in a reasonable state of repair, we might have been able to do the odd spot of capturing, in the way of taking over enemy-owned real estate.

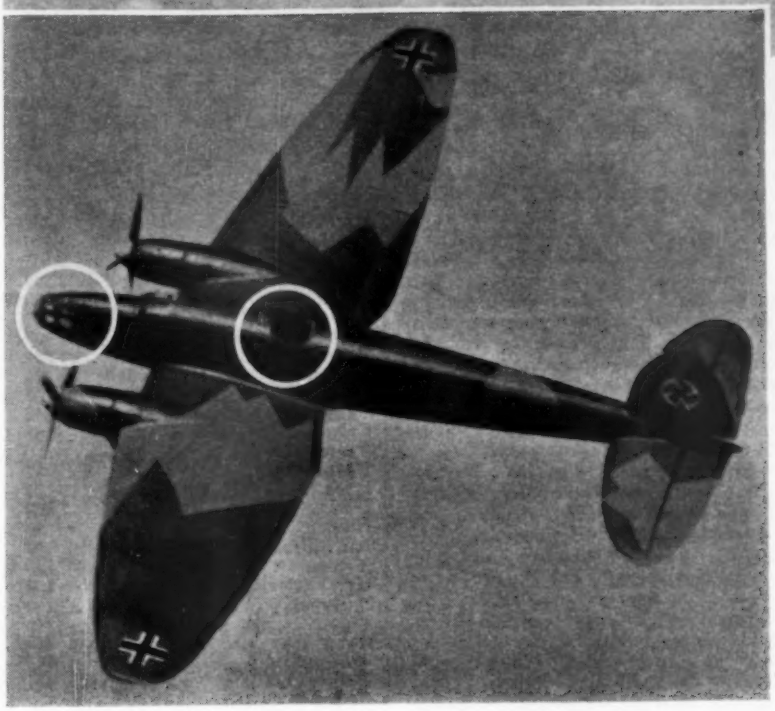
The book of directions was simple. It is quite obvious that half a dozen men were not capable of taking over a quarter of mile of trench and holding it. So the idea was to create the impression that the aforementioned chunk of earthworks was being protected by several regiments in full active service equipment.

This is how it was done.

As soon as we spotted Fritz taking sights on us and making any attempt to figure out who or what was in front of him, we used to go to work and put on the act. Two would bang on lengths of elephant iron with the hammers. Two more would run up and down the trench dragging empty biscuit tins on wire. The rest would canter up and down with loaded rifles and at intervals fire over the sandbags and attempt to give the impression that at almost any minute 49 regiments of the Black Watch were about to hop over for a haggis party.

This is the much-touted and greatly over-rated Messerschmitt fighter.





The two photographs (right) show how the Germans have converted the Heinkel transport to a bomber by adding gun emplacements (circled in lower photo).

We kept this up until we were all weary—or had laughed ourselves into complete exhaustion.

Of course it is just as well that Fritz was *not* curious. We would have looked very silly, had he come over to investigate what must have sounded like a beer-kettle factory working overtime.

But today, the tables have been turned. Today, it is Fritz who is banging on the elephant iron, rattling the biscuit tins and firing the odd shot here and there. We've been peeping over the sandbags for some time now, trying to figure out whether this gag about 9,000 fighting planes is the Von Coy, or just another game. We've been a bit suspicious for some time, but it wasn't until Herr Hitler tipped his hand completely in October, and tried to get the British and French to lay off building fighting planes that we knew we were right.

That one move gave the whole show away. What with Britain adding 41 complete squadrons in nine months and 30,000 people signing up for the Civil Air Guard in six weeks, and more and more Hawker *Hurricanes* rolling out of the Kingston-on-Thames factory, Hitler saw that his game was up. You can't bluff off *Hurricanes*, *Spitfires*, *Gladiators* and Bristol *Blenheims*. Hitler saw the writing on the wall and tried to get out the whitewash brush—but it wouldn't reach.

I have tried to sell this story to the big newspapers and several of the big magazines, but they won't touch it.

"How can we use such a yarn, even if it is true?" they say. "All the noted experts have told us over and over again that Germany has the greatest air force in the world. We've printed all these stories. How can we debunk them now?"

Moral: Read POPULAR AVIATION.

Actual figures collected from responsible sources disclose that Germany's air strength of what she considers first-line planes is only 700 military ships.

"But," you will charge me, "well-known airmen, who claim to have been abroad and seen the German air force, say that Germany has at least 5,000 fighting planes."

Do you know how long it would take for one man to travel about and see 5,000 fighting planes? Months—even were he allowed to do so.

Let's get down to facts, and see how all these crazy air power figures stand up under the old grilling.

Since 1909 when the Wright brothers set up their first factory about 60,000 airplanes have been built in the United States. Are they going to tell us that Germany can put out 9,000 or even 5,000 first-line planes in the three years they have been in the fighting plane business? Are they going to tell us in the face of the fact that it takes anywhere from five to seven years to design, build and put a fighting plane in some air service hangar, that Germany can build 5,000 in three years?

Pre-supposing they could, where would a bankrupt Germany get the money to build that many planes at an average cost of $40,000 a ship? And if they actually have them, where are they? You can't hide 5,000 fighting planes in a beer garden. And besides, someone has to fly them sometime—somewhere.

After all, foreign airmen have been flying over Germany for years as pilots of airlines. Isn't it reasonable to assume that one—just one—of them might have seen some evidence of all this air power?

It so happens that I have friends abroad. Some are airmen, some are scholars in German universities and some are just plain Germans. They write me now and again and, naturally, we mention military aviation. They often send me German air magazines which contain articles or photographs of interest and there are times when I have a night off and sit down and read.

It's a very simple process. Nothing underhand about it. If you passed the fourth grade as I did, you can add two and two together and get some sort of an answer. But let us suppose for a fleeting moment that, by some process of mass manufacture, the Germans have developed this amazing armada of fighting craft and have distributed them out to all the *Jagdstaffels*. Where the deuce do they get the 9,000 or 5,000 pilots to fly these 300 m.p.h. marvels?

Here in the United States where we have the money, the flying schools and the equipment, we have found it pretty difficult to turn out 300 fully trained pilots a year. Remember—we have all the breaks on geography and climatic conditions for all-year-round flying, and out of the 300 turned out there is still a question as to how many are actually capable of flying a first-line service ship. I say this with all the respect in the world, but facts from the U. S. Army's Air Corps News Letter indicate that out of the 250 or so starting each year's class at Randolph Field, only a few actually become what fighting airmen would call real military timber.

And they want to tell us that Ger-

Frank Tinker flew old American ships against this modern German fighter (see our September issue) in Spain, reported the German ships "only second-rate fighters".

many can turn out 9,000 or 5,000 fighting airmen in a few years? How do they do it—with gliders?

But perhaps you are still not convinced.

The "experts" who have returned from Europe continue to stuff the details of the great Messerschmitt 109M down our throats. That's the boiler that did 397 m.p.h., or something like that, over a closed course for what stands as the world's landplane speed record. As you have been told in POPULAR AVIATION so many times, that particular model was a souped-up version stripped down for speed. The 950 h.p. Daimler-Benz DB-601 engine was hiked up to 1,300 h.p. for the big event. *But* the standard service types now in use by the two German squadrons equipped so far are powered with the 650 Junkers *Jumo* engine because, so far, they have not found enough Nazi pilots capable of flying a 397 m.p.h. fighter—and who has?

Then there is the beautiful legend about the great Heinkel He-111 which has been sent on several fanciful bombing raids over London and Paris. This beautiful piece of equipment is not a bomber at all, but a revamped version of the He-111 transport plane. Close study of photographs of the two types indicate that the B.M.W.V1-60Z motors have been changed to inverted-Vee Daimler-Benz power plants and to make it *look* like a bomber they have tacked on a birdcage nose to keep the gunner from falling out.

What the lads who came back with all the news didn't tell us was that these converted transports do not always work out. They were originally designed to carry a certain passenger load distributed along the fuselage, but when they tried to carve bomb holes, gun turrets and build in prone-position bombing stations, the whole center of gravity was changed and she had to be completely re-designed before they could kid anyone to take her into the air.

Another pippin for the books in this great German Air Menace has been the unfortunate disclosure that the highly rated Junkers Ju-87, which was offered as a dive-bomber, looked beautiful in the foreign newspapers. But when Herr Fritz Mangelwurtzel was asked to take her up and dive her, there was quite another story.

They had to redesign that one and add specially strengthened flaps to *reduce the diving speed!* The model, we have been *warned* has now been placed on the export market and I presume the Germans hope the French or British will buy a few hundred and try to dive them.

The Germans like all others are continually experimenting with what we in the writing racket call prototypes, and once they get one that photographs well, they make the most of it. The propagandists do the rest by turning them out by the thousands and scare hell out of everyone.

It's like us talking about the big Boeing bomber—you know the XB-15, the big one. We like to think that we have hundreds of them, whereas we only have one. And that one, according to General Arnold, the new Chief of the Air Corps, is too big, too expensive and limited in scope and so they are not going to build any more. They don't play that up in the newspapers either, nor do they tell you in headlines that bombers are to be limited in weight to something between nine and 20 tons.

I have been asked why, if what I say is true about the German Air Service—and I only need to quote page 420 of the 1938 edition of Whitaker's Almanac if you must have actual figures—why it is that our experts, papers and magazines continue to play this German Air Menace up?

In the first place it can be used or

(*Continued on page 74*)

WORLD AIR STRENGTH

Country	First Line Craft	Total Types
Great Britain	2,382	3,450
France	3,000	3,400
United States	2,400	3,200
Russia	1,500	4,700
Germany	700	2,525
Italy	2,000	3,000
Japan	1,500	2,000
Poland	700	1,300
Czechoslovakia	566	900
Roumania	800	1,000
Yugoslavia	800	900
Netherlands	270	400
Belgium	210	350
Canada	190	400
Australia	40	60
Egypt	27	27
India	200	(?)
Iran	200	300
Iraq	36	50
Irish Free State	18	40
Mexico	42	(?)
New Zealand	28	100
Portugal	110	150
Siam	210	250
Sweden	180	(?)
Switzerland	160	300
Turkey	370	(?)
Union of South Africa	38	66

AIRCRAFT CARRIERS

	Built	Projected
Great Britain	6	4
United States	6	3
France	1	2
Japan	4	3
Italy	0	0
Germany	0	2
Russia	0	0

If the Nazis are building the tremendous air force they claim, why are they exporting their latest-model Junkers bombers to foreign nations? The batch below is typical of some export orders delivered.

by MANLEY MILLS

One wouldn't think a waltz or even a swing session had anything in common with flying. You'd be surprised.

HAVE you ever noticed the fact that a great majority of airplane pilots play some musical instrument, especially the piano? Al Williams and Casey Jones, for instance, are among the notable airmen who are capable pianists. Mussolini, aside from his official duties, has gained recognition as a first-rate airplane pilot; but not so well-known is the fact that he also has a practical knowledge of music. On the other hand, quite a number of professional musicians are holders of pilot's licenses. One of the first who comes into mind is Wayne King, the popular orchestra leader and composer.

If you'll do a little investigating among pilots of your acquaintance, you'll find that, in a surprisingly large number of cases, musical and flying ability go hand in hand. Such cases are so common that they can hardly be attributed entirely to coincidence. The truth of the matter is that playing a musical instrument, especially the piano, is more like flying than anything else. Offhand, you'd think that the two had nothing in common and that playing the piano was just about as unrelated to flying an airplane as anything could be. While this is true as far as the physical sensations are concerned, playing this instrument demands practically all the faculties of mind and body that flying an airplane does. In other words, when you play the piano, you must have complete coordination of mind and muscle, and a highly developed sense of rhythm and split-second timing. These aren't the only requirements but they're the fundamentals. The same faculties are necessary when you fly an airplane, so it's only natural that a pilot should find that learning the piano is a cinch for him.

Conversely, the prospective pilot who is able to play the piano will have developed the all-important fundamental qualities, which will be of great benefit to him in acquiring the knack of handling the controls when he takes up flying instruction.

Some psychologists claim that skill or dexterity in doing one thing doesn't necessarily help you to do something else in which skill is required unless the actual movements happen to be similar in both cases. For example, a person who is an expert on the typewriter will find his accomplishment of little value in learning to drive an automobile. Yet, there's nothing in this theory that denies the obvious fact that whenever you do something that requires a certain combination of mental and physical attributes, any activity that develops these is bound to be helpful. A surgeon, for instance, must possess accuracy and steady nerves. Target practice will help him to acquire these traits, though the mechanical movements of sighting at the target and pulling the trigger are not at all like those of removing an appendix. The same principle applies in the relation between flying and musical training, only to a much greater extent.

Music teachers, in giving reasons why a person should study the piano invariably stress the point that, aside from its cultural and entertainment value, such training develops all the mental faculties to a high degree. Since no other accomplishment requires the use of so many of them as flying does, piano instruction is one of the best kinds of preparatory work for anyone who wants to learn to fly.

Ask any music teacher what the very first thing is that a piano student must learn. Nine times out of ten, the answer will be, "Relaxation". Ask any flying instructor the same question and the chances are that you'll get the same answer. The reason is very simple. Complete muscular control and quick response to brain stimuli aren't possible when the nerves and muscles are tense. A striking demonstration of this fact is in target shooting. A novice is usually tense and nervous, and his muscles are contracted. Under such conditions, he usually misses the target, but when he learns to relax an immediate improvement in shooting will be noticed. For years, nervous energy has been regarded as something similar to electricity, but recent scientific experiments have shown that it actually *is* a form of electricity both in its origin and behavior. When the nerves and muscles are in a state of tension, the effect is the same as a resistance in an electric circuit. As a result, the reflexes become slower and uncertain.

Of course you can't expect to relax at the very beginning, either at the control stick or the keyboard. An initial feeling of tenseness is quite natural and common. Here's where a salient point in favor of piano training is brought out: It's one of the best ways to master the art of relaxation because, from its very nature, playing has a soothing and sedative effect.

Flying an airplane demands quick thinking, and the ability to do the right thing at the right time almost without conscious effort. And there's no better way to develop this ability than in piano practice. By the time he has learned to play fairly well, a person will have trained himself to think at least four times as fast as the average man. In playing some exercises and compositions, the notes that have to be played within a space of a few minutes are often in the hundreds or even thousands. And they must be sounded at precisely the

(Continued on page 72)

UNCLE SAM LOOKS WEST

by JAMES BASSETT, Jr.

Much of America's aeronautical future lies in southern California. Here are concrete reasons.

Of all the world's present-day airliners, none sold so widely as Douglas's famed DC-2s and DC-3s. One of the latter is shown above.

UNCLE SAM'S potent scrawl had been drawn across the bottom of $1,000,000 Works Progress Administration check; out on the serried, mesa-like field near Albuquerque, N. M., men were scrabbling at the sage brush and laying the groundwork for broad, 7,000-foot ribbons of concrete.

From the desert floor near Boulder City, Nev., which prospectors only a half-century earlier had left disgustedly to the greasewood and rattlesnake, another miracle was arising.

Both were modern airports.

Each could accommodate with ease a 13-ton Douglas DC-3 swinging in for a landing with 21 passengers strapped in their chairs.

Recently something else happened. It links with these foregoing events, though it concerns far different things and persons. In Washington, Secretary of War Woodring announced that the Army's General Headquarters staff, headed by good, gray Maj.-Gen. Frank M. Andrews, would trek 1,000 miles from Langley Field, Va., to Scott field, some 275 miles southwest of Chicago.

That move will cost the Federal government a cool $4,000,000, because Scott Field used to house lighter-than-air craft, and needs plenty of reworking to be made a suitable G. H. Q. base.

Why all this?

Albuquerque, a way-point on only one airline's (TWA's) cross country skyway, will soon possess one of America's best airports. Its plentiful field-space can give shelter to 2,000 planes at once. Its runways afford take-off room to much larger and less-wieldy transports—or bombers—than fly today; and in years to come, Albuquerque probably won't even lie on the route of the largest planes.

Boulder City stands adjacent to Boulder Dam. And it's a thriving little city.

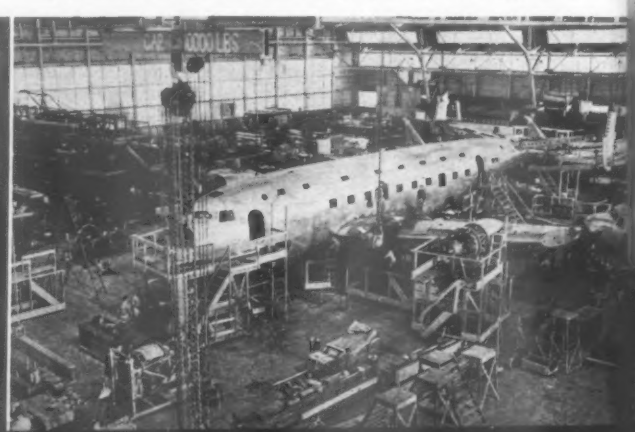
Here's why: national defense and the amazing growth of the Western littoral of the United States, that strip of coastline along southern California, demands such steps. There's an industry that today holds contracts for $70,000,000 worth of airplanes nestling beside the blue sea. It needs protection.

The G.H.Q., almost midway between two oceans, is better able to defend, to order protection for, this business. And if that almost fantastic contingency ever came—demanding that aircraft hustle inland from the Pacific—Albuquerque and Boulder City, 700 and 300 miles from Los Angeles respectively, would lie convenient.

What is this industry that needs such safeguarding? It is one of the vertebrae in the nation's defense backbone. Warplanes, bombers that can span the country in 12 hours and attack ships that can

Below you see part of the Douglas company's tremendous backlog ($25,400,000) under construction. The ships are B-18s.

Biggest "long shot" in present-day manufacturing is Douglas' $1,500,000 DC-4 (below) which they hope to sell to five airlines.



At right is the prosperous Lockheed company's factory. A new building is being erected on the automobile parking lot.

strafe the daylights out of disembarking invaders, emerge from their cocoons here. So do the transports that wing their way around the civilized globe.

Aviation's Big Business in southern California today.

Nowhere under the sun is there such a concentration of aircraft building. Not even Germany, with its teeming Junkers plants that straddle the Reichland, can match this portion of a single state. Four huge factories' wheels spin mightily. Into their offices come orders from England, Australia, Canada, the Netherlands, Jugoslavia, Japan, Turkey, the nations of South America, Central America, the East Indies, Poland—and others.

They talk of backlogs. These are unfilled orders. They keep thousands of men employed.

Douglas Aircraft Corporation of Santa Monica boasts the largest southern California backlog: $25,400,000. Only one other U. S. firm surpasses this (United Aircraft Corporation) and that not by much.

Second is Lockheed Aircraft Corporation with $21,000,000, largely the result of John Bull's recognition of American aeronautical genius and his purchase of 200 reconnaissance bombers for $17,000,000.

Third comes North American Aviation, Inc., a General Motors subsidiary, with $16,500,000, also thanks to Great Britain and a contract for 200 basic combat ships at $8,000,000.

Vultee Aircraft, a division of Aviation Manufacturing Corporation, ranks fourth with $1,500,000. Low in backlog because of an unprecedented delivery of almost $4,000,000 worth of single-engined scout-bombers in the first eight months of 1937, Vultee today hankers for the export and domestic military trade.

Then come the "minor" businesses. Thriving little Menasco Manufacturing Corporation has emerged from the job of building in-line engines for sportplanes and racers, and now shows a $1,000,000 contract for Diesel engines. These small motors, British-designed, presage an eventual expansion into the long-awaited Diesels for American aircraft. Other southern California firms book orders in the high thousands.

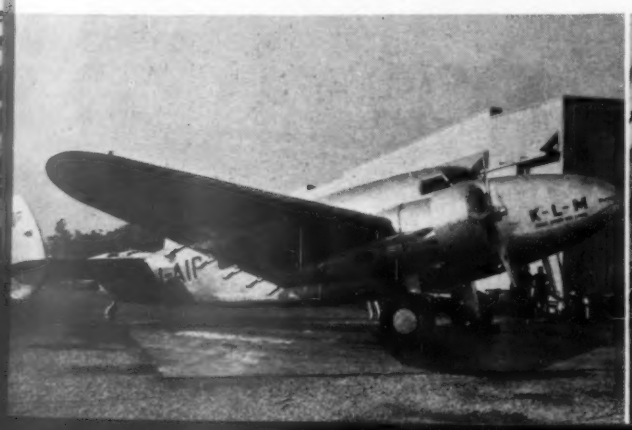
Oldsters will remember the hectic days of 1917. In that war year, fledgling aircraft companies that had sprung up overnight turned out rickety "fighting" ships like half-baked cookies. Last August, for the first time since that cataclysmic year, this production record was touched. But it wasn't made by a fly-by-evening company building cheesecake machines. Respectable North American did it. They did it in making fast, sleek combat and training planes for War and Navy departments, and for equally finicky foreign governments.

Airlines of the United States come to southern California for their 200 m.p.h. transports. They go nowhere else. Douglas, pioneer of the modern, low wing metal monoplane for passenger use, gets the bulk of this business. Its $110,000 DC-3's, that are fashioned into sleepers, club "cars" and 21-seated day "coaches," go to every major transport firm. Abroad, airlines like the DC-3 too Dutch K.L.M., for example, sends Douglases into the tough-flying country of Java.

Companies that have fast-flying demands, smaller payloads and tougher schedules shop around at the Lockheed factory lying hard by Burbank's busy Union Air Terminal. For $60,000 they can purchase a Model "14" that seats 11 passengers, speeds 230 m.p.h., and can keep pace with any commercial flying-machine on wings. Lockheed points happily to Trans Canada Airlines. Here its product skips over the Northern Rockies.

Let's look closer at Donald Wills Douglas' sprawling hangars that sunbathe near the Pacific at Santa Monica. In August, Mr. Douglas' 8,000 workmen turned out almost $2,000,000 worth of domestic and foreign aircraft. Most of this represented transports. But much was Army and Navy equipment. The highly secret TBD torpedo bomber, whose wings fold like a bird's for storage below a carrier's decks, went to the sea forces by the score. For the Army, Douglas redesigned its twin-engined B-18 bomber. This B-18A is already rolling at the rate of four a week. National defense on the upswing—and the Air Corps rapidly approaching its July,

Lockheed's "14" will surpass that company's popular Electra in numbers sold because of the British order for 200.



All manufacturers look with longing on export markets. The Electras below are being shipped to a New Zealand airline.

A new development that promises even more aeronautical manufacturing fame for California is the twin-engined, single-propeller Unitwin developed by a Lockheed subsidiary. Above is an experimental installation, top a ship designed for Unitwin.

1939, goal of 2,600 first-line warplanes.

Now a closer scrutiny of Lockheed and its 2,700 men. On 50 acres of flatland in San Fernando Valley, this company that began from scratch within the memory of any high school kid today draws air ministry missions from England, France, Australia. Lockheed has started to buckle into its 200-bomber order from the Old Country. Other shipments will go to Rumania, Australia, Canada and Jugoslavia.

To the War Department will go a fleet of 13 "12's." Trim as a dollar cigar, these will carry Uncle Sam's aerial bigwigs and will serve as transport-trainers for fledgling *Flying Fortress* pilots.

Business pretty good? Yes. British Airways, which skips the channel to Paris and Stockholm, cabled last month for two more Model "14's" in a hurry. They already flew four. But with Prime Minister Neville Chamberlain choosing the Lockheed for his first flight, the stamp of approval seemed to be on this Yankee craft for a fact.

Back into the picture, too, will go the famous old name of Vega. Amelia Earhart and Wiley Post made Lockheed *Vega* a name to be reckoned with in the slambang early 1930's. Now in a new guise and propelled by the new Menasco "unitwin" (two in-line engines geared to one crankshaft), Vega again will fly. It's designed for the rapidly growing feeder-line business.

Back to North American. With 3,500 men working end-to-end shifts on military orders, and the South American field apparently wide open to its energetic salesmen who can offer a cheap ($17,000 without engine) basic combat craft for export, this General Motors wing possesses an enviable spot in the foreign business picture. It's settled in Australia, and is dickering for Canadian manufacturing rights.

Vultee wants foreign trade—and some domestic business with the Army Air Corps. For the first time in its hectic history, this outfit whose single-engined transports once winged over many U. S. airlines before the Bureau of Air Commerce promulgated the multi-engined requirement for passenger traffic, boasts Army orders. Seven of its YA-19 attack bombers complete with spare parts are underway for the War Department. Of these Assistant Secretary of War Louis A. Johnson, whose own particular baby is the flying branch of the Army, said: "These are the largest, fastest single-engine attack planes yet procured for the Army. They are believed to have no superior in the world."

If Vultee's backlog is small and its payroll comparatively light, its engineering force of 102 college men is at its all-time peak—one-sixth of all the workers employed at this Downey plant. Why? Because they want the factory's 139,000 square feet to resound with riveting machines and metal cutters. They want that huge hydraulic press to start stamping out the unique Vultee "perfect-cylinder" fuselages in big numbers again. So Vultee today rushes plans for its faster (250 miles an hour) light mission bomber.

Within hollering distance of Los Angeles' tall City Hall, a score of other, smaller aircraft and allied industries work night-and-day. The Timm brothers have their high-wing, twin-engined, part-wood transport ready for marketing, and many an order on hand. Vance Breese's low wing plastic wood bi-motored transport is also ready for feeder-line and foreign use. Waldo Waterman's "arrowbile," the motorcar that flies like an airplane, has been announced as a flexible flying tank.

Big things bode for aircraft's future in Southern California.

For the nation and the world, too.

Here will take shape two of the Air Corps' deepest secret projects. Not long ago I was told by an officer high in the air service that twin-engined bombers must go; that they are a stopgap machine whose tactical range is exceedingly limited. In their place he wants bigger, many-motored machines. Larger, even, that the colossal Boeing XB-15, he said.

This officer'll get them. For at the Douglas plant, in a secluded hangar, something so large that it frightens one to contemplate, arises. Designed for the future *today*, it will be a bomber whose size will dwarf the thin-bodied Boeings

The Timm brothers' twin-engined, tricycle landing-geared transport ready for marketing, many an order on hand.

One of the many currently successful designs produced by North American is the 0-47A (below) for the National Guard.

as a football overawes a cigar. Specifications are secret. But this much is known: it will reach 160,000 pounds, span 250 feet from wingtip-to-tip, and be capable of sustained flight to Europe and home again from Manhattan. So much for size.

Speed and maneuverability of the kind sought by Maj. Alex ("Sascha") de Seversky in his blunt-nosed pursuiters will be found in another secret Army project underway at Lockheed. Twin-engined and a fighter, this mysterious craft will rank with the Bell *Airacuda*. To protect bombers on long missions, de Seversky has said, pursuit and fighting ships must ride long distances side-by-side with the T. N. T. carriers. This plane may do it.

Meanwhile, Douglas' engineers have been toying with plans for a Model DC-5; Lockheed draughtsmen with a Model 27. With many a nebulous sketch still in the air, the Santa Monica crew which once set the transport game on its ears with the low wing, pioneer DC-1 has projected a dozen tentative blueprint models. One currently favored is a *highwing* craft seating 30 persons.

Lockheed's Model 27 will aim at the field now usurped whole-hog by the Douglas DC-3. It will combine the 14's speed with size—probably a 21 seater.

Truly, aviation moves forward at a pace exceeding its own products. And this speed and change isn't the mere re-rigging of doodads popular in the automotive industry. When a new aircraft appears, its speed has been upped many miles per hour, its carrying capacity has been enlarged enough to house many dollars worth of pay passengers, and its accompanying safety factors of reserve horsepower, reduced landing speed and extra structural might have been similarly increased.

These pioneers aren't using blunderbusses and ox teams. They've taken up the slide rule and the wind tunnel. They're flying higher (with the Army-Lockheed substratosphere ship), faster (with Howard Hughes' own 252-m.p.h. monoplane which he hankers to sell to the War Department) and farther (with the Douglas DC-4 which will span the U. S. in a single, abbreviated hop).

Thus Uncle Sam eyes his Pacific Coast from Seattle to San Diego warily. His eyes glint brightest when they view southern California.

In times of war, these teeming factories would be more precious than that deep hole-full of gold in Kentucky. Because you don't save cities from destruction by tossing ingots at invaders. No! You meet 'em more than halfway with more, better fighting equipment than they can show.

Last month I saw the Army's might fly over Los Angeles during maneuvers. A day later the Navy paraded over the Fleet in Los Angeles Harbor. These are wartime machines in a peacetime country. They are insurance as surely as if they were stamped, sealed annuity policies. At the rate of $70,000,000 per year, they are increasing. We must keep the production belts moving, moving, moving.

The Vultee company, now an independent manufacturer, has been doing good business in the exporting of single-engined high speed bombers like those being built above.

Even as this is written additional orders are pouring into the California plants. Latest order went to Lockheed and came from the Australian Air Board. The Australians have ordered 50 reconnaissance bombers similar to the 200 ships ordered from the same firm by Britain's Air Ministry. These export bombers are military versions of the "14" airliners that now are in service on Northwest Airlines and Trans Canada Airways. In the Lockheed company's case, the Australian order boosted the firm's backlog by approximately $4,500,000 to a total of more than $28,500,000. The Australian ships, to be powered with American *Twin Wasp* engines, are scheduled for delivery next year.

END

Vultee's backlog is comparatively low because of the unprecedented deliveries of export scout-bombers like those below. They sold $4,000,000 worth of this model.

I Flew On A JAPANESE AIRLINE

by HARRISON FORMAN

A world-famous explorer and writer describes some interesting experiences on his most recent visit to the Orient. An exclusive article.

Above is a typical Japanese airline poster. The ship is an American Douglas DC-2.

FROM San Francisco to Japan in four days will soon be a reality according to an ambitious announcement from Tokyo on July 23rd by the Ministry of Communications.

With an appropriation of Yen 7,000,000 (about $2,100,000) which will be asked for in the next session of the Imperial Diet, it is planned to start a weekly service from Tokyo to the Mandated Islands in the South Pacific, thus enabling travelers to make connections with the Pan American Clippers which operate regularly between San Francisco and Hong Kong. The Clippers land at Guam, just a hop-skip-and-a-jump from the island of Saipan in the Mandated Group, which will be only nine air hours from Tokyo.

The Tokyo-Saipan route will extend to Palau and Jaluit, with another connection from Palau to Tainan on the southern tip of Formosa—a flight requiring eight hours. There is already established a regular daily air service encircling the island of Formosa, and another daily service from Taihoku (at the northern tip of Formosa) to Tokyo, via Naha in the Loochoos and Fukuoka.

Established in 1929, the Japan Air Transport Company, operating under the supervision of the Ministry of Communications, began with a modest Tokyo-Osaka three-hour service. Since then, particularly in the past several years, the J. A. T. has expanded amazingly until to day its service extends from the frigid island of Hokkaido to the tropical coral reefs of the South Seas Mandates, linking the key points of East Asia with only steamship transport, for the most part, as competition. Perhaps 75 percent of its scheduled routes lay across open water. Be that as it may, landplanes are almost exclusively used.

In the past few months I have done quite a bit of flying on the J. A. T. lines. With only a limited few months to spend out here each season to gather material for my winter's lecturing, I am reluctant to waste days at sea when planes are available to span the same distances in almost hours.

So when, for example, I heard in Tokyo that the J. A. T. operated a regular daily air service to Formosa—that little-known island of head-hunters and treacherous coastlines (the *S.S. President Hoover,* queen steamship of the Pacific, was wrecked on Formosa rocks last December)—I decided I would make the flight—if it be possible.

Foreign friends in Tokyo pooh-poohed the thought.

"There's a war on in these parts, haven't you heard?"

Yes, I had heard. I knew also of the Japanese reluctance to sell air tickets to foreigners in these times. Particularly, to strategic Formosa. But I was determined. I set friends to work pulling wires, seeing So-and-So and So-and-So. It really wasn't so difficult a thing to put over as anticipated. Assured I was no foreign spy, there suddenly appeared no longer to be any obstacle in the path of my wish.

Tokyo's Haneda airport is more than an hour's drive from the Imperial Hotel. That is, with an ordinary taxi-driver. But there are no ordinary taxi-drivers in Tokyo—they're all race-track drivers. Or at least appear so—particularly, when an opportunity is presented to prove to the airport-bound passenger a kinship in daredevilness with the pilot of the waiting plane. But then. . . .

There is a "local" and an "express" service from Tokyo to Fukuoka, the

Even Japan's commercial airmen prefer American aircraft. The owners of this Beechcraft use it for charter work.

British aircraft also are used in Japan. This Airspeed design is built in Japan by the Mitsubishi company under British license.

jumping-off place at the lower tip of Japan proper. The fare is Yen 55 for the "local" and Yen 65 for the "express"—about equal to first-class train service in Japan. The "local" service operates an eight-passenger Fokker FVII-b 3M powered with three 225 h.p. Wright *Whirlwinds,* and stops at Nagoya and Osaka. The "express" plane is a 14-passenger Nakajima-Douglas DC-2, Japan-built, engined with two 710 h.p. Wright *Cyclones.*

My Douglas was scheduled to leave at 7:00 a.m. It's a three hours and 40 minute non-stop flight to Fukuoka. And a beautiful flight it is, too. Hardly out of Tokyo we pick up on the skyline peerless Fujiyama. What an unforgettable sight is this extinct volcano rising nearly two miles high almost from the very shore of the sea, its snow-capped cone a glistening white silhouette against a deep blue sky.

Mountain ranges are alternated with broad fertile valleys of irregularly-shaped rice-paddies, which from the air appear like some huge stained-glass window. The Inland Sea is followed below Osaka with its numerous islands each a bright green spot in a setting of unruffled blue.

Fukuoka is as modern an airport as any in Europe or America. Planes arrive from Tokyo, from Formosa, from Manchukuo, North China, Shanghai, etc., with surprising regularity and are despatched again with clock-work efficiency.

There is a 30-minute stop here while our DC-2 is refuelled and groomed for the long over-water flight ahead. At 11:10 a smartly-uniformed girl approaches and hands each one of us a lunch-box. Then:

"Dozo," she says politely. "Please." And she motions to our plane.

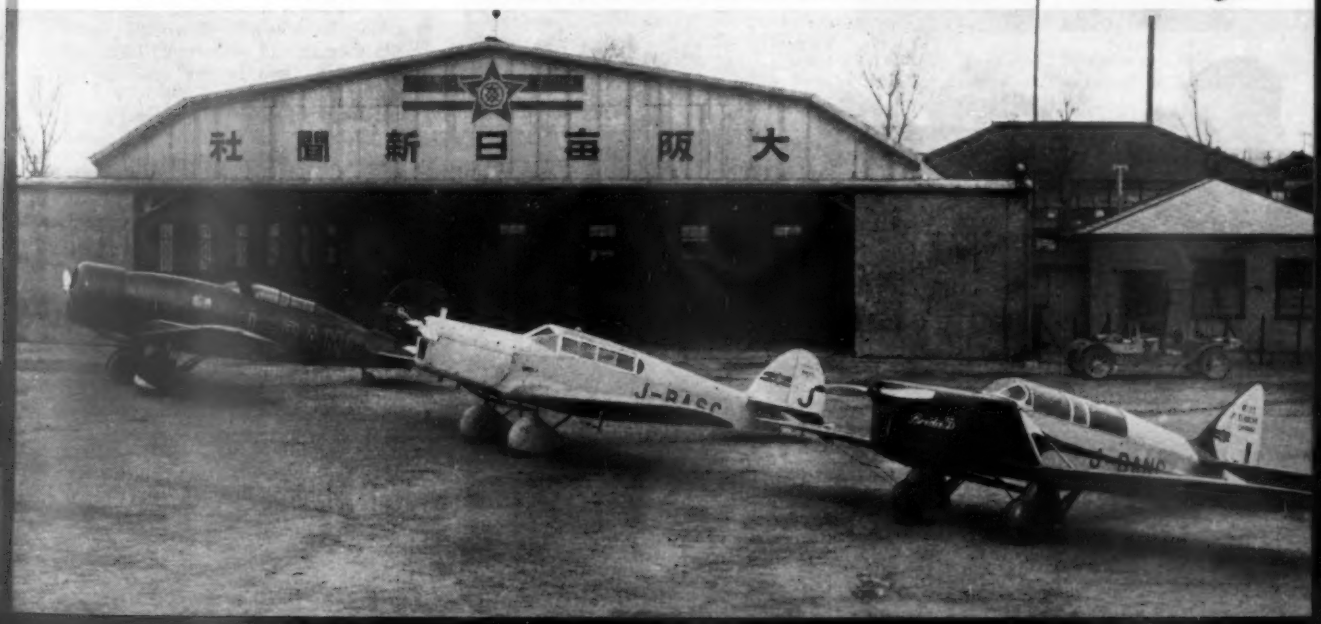
Good pilots are these Japanese. But their more-or-less general propensity for reckless showing-off is disconcerting to one who has any knowledge of flying. It's the only thing to which I can attribute their annoying, to say the least, actions. For certainly they know better, or should know better, than to cock a plane-load of passengers and express over into a 30 degree bank, with barely

(*Continued on page* 80)

Even the Japanese are becoming more and more educated in the ways of modern airline transportation. Above is the waiting room in Tokyo's new, completely modern airport.

Another type ship flown on Jap airlines—despite its age it still is popular there—is the American Fokker Super Universal shown above about to be set in the water.

Below are three Japanese commercial airplanes. Left to right are an American Lockheed, British Percival and Italian Breda.



Above is the way one airline puts it. The picture at right is a typical gag.

CUPID • GETS • STREAMLINED

by SELBY CALKINS

There's romance in the air and the airlines are cashing in on it. Flying-to-your-wedding is big business.

ROMANCE in this world of 91-hour flights around the globe has gone as streamlined as Col. Roscoe Turner's Thompson Trophy speedster.

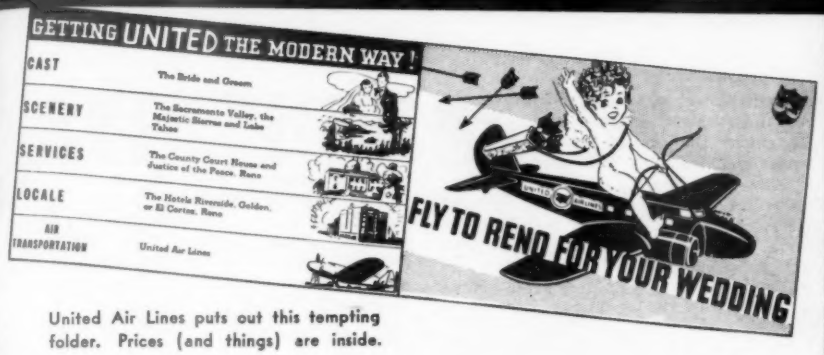
Justices of the Peace are looking for homes close to the airport and the modern-day Romeos have found that whenever they have trouble convincing their Juliets they should be married forthwith —an airplane trip to the altar is the clinching argument.

Aerial elopements . . . they catch a girl's heart with a peculiar little twist, it seems, and make a man feel like a dashing sort of fellow indeed.

Once there must have been a pusher pilot who twisted his cap around the back of his neck, lured his sweetheart onto a seat in his box-like crate and flew off to the county seat for the first aerial honeymoon trip of record. That couple started something!

Many a pilot has since made a Cupid's chariot of his ship, but in recent years this business of plane elopements has grown from a romantic practice of pilots to a near industry, according to

At left is Max Baer seeing a friend married at Phoenix airport. Note "audience".


GETTING UNITED THE MODERN WAY!
CAST
The Bride and Groom
SCENERY
The Sacramento Valley, the Majestic Sierras and Lake Tahoe
SERVICES
The County Court House and Justice of the Peace, Reno
LOCALE
The Hotels Riverside, Golden, or El Cortez, Reno
AIR TRANSPORTATION
United Air Lines
FLY TO RENO FOR YOUR WEDDING

United Air Lines puts out this tempting folder. Prices (and things) are inside.

scores of airplane charter operators and airline traffic men here and there in the United States, especially in commonwealths blessed with so-called "gin marriage" laws. (These are the laws that require an interval of several days between application for a wedding license and the ceremony. Usually one or more neighboring states [surely by coincidence!] doesn't have such a law and welcomes elopers.)

Let's use California as an example:

Here is a state with a three-day marriage law, with nearby Nevada and Arizona having practically no marriage restrictions at all. A state where the aerial elopement has really become a business and where even the reverse of the idea—an alimony airline to Reno—has been tried!

It must have stemmed from the perverse rivalry between Los Angeles and San Francisco . . . at any rate two staid San Franciscans, after reading of a veritable epidemic of Los Angeles aerial elopements, apparently thought that if couples would plunge headlong through the air to get married, disillusioned individuals would be at least equally as anxious to reach Reno and undo the preacher's knot. So was born the "Alimony Express" which shuttled back and forth to Reno and then detoured on a one-way hop into the bankruptcy court.

Ironically, their trim cabin planes were sold to an operator who used them in a healthy charter business—to Reno's marriage mill! Just another victory for Cupid over divorce—and "big business" hasn't been slow to climb aboard the elopement-by-air bandwagon, what with airlines offering all-expense wedding trips, scheduling "Cupid's Specials", issuing solemn traffic bulletins to ticket agents and wooing high pressure Chamber of Commerce cooperation!

Phoenix (Arizona) Chamber of Commerce funds built a wedding chapel on the city's Sky Harbor airport for the Los Angeles marriage trade; Yuma countered this insidious attack on its "Gretna Green" reputation with provisions for day and night service; Las Vegas cultivated a cactus garden for starlight weddings at its airport (was there a cynical note in this gesture of the divorce state's second city? There *could* have been a rose arbor!) and made it a three-way contest.

These cities, already regular ports of call for the charter pilots, awakened to this frenzied activity only when huge airliners began carrying starry eyed brides and nervous grooms-to-be on regular trips, yet the spur of the moment elopement still preponderates.

Joe Lewis, whose Lewis Air Service has been one of the favorites of air-minded elopers for years, was summoned from bed before dawn one day.

"My caller, a well known motion picture star, wanted to start for Yuma right away," Lewis related. "In fact he wanted me to have the motor all warmed up when he and his prospective bride arrived.

"I suggested a delay of an hour or so —I was pretty sleepy—explaining that they would have a much prettier trip by daylight.

"'Nothin' doin', he said. 'She may change her mind before I get her to the airport—think I'm going to wait another hour?'"

Joe won't tell their names, because she hasn't changed her mind yet.

One of the pioneers in this business of playing aerial chauffeur to Yuma-bound couples was dapper Col. Roscoe Turner before he entered the ranks of the country's foremost speed pilots.

Roscoe found himself with a Travelair cabin plane on his hands and income non-existent. With typical Turner showmanship he painted a Cupid, complete with drawn bow and quivver full of arrows, on the side of the ship and painted "Honeymoon Express" in flowing script the length of the fuselage. The idea caught on. Business showed a marked improvement, at the rate of $125 per round trip to Yuma.

And when Columbia Studios made a picture with the title lifted from Turner's ship—Roscoe rented them the airplane for the aerial sequences!

Turner hangared his plane with Paul Mantz, operator of the United Air Service at Burbank, near Hollywood. Mantz specializes in furnishing airplanes and pilots for aviation motion pictures and between films uses them for charters. His planes have carried wedding parties to Reno, Las Vegas, Yuma and even Ensenada in Old Mexico. Among his clients have been William A. Wellman, top ranking director, when he and Dorothy Rae Coonan were married in 1934; Ted Healy, late beloved comedian, and Betty Hickman, a university co-ed at the time of their elopement; William Keighly, Warner Brothers director, and screen star Genevieve Tobin in their surprise elopement; and fast talking Lee Tracy when he and Helen Thomas de-

Another Phoenix airport marriage was that of Actor Scott Colton and Azadia Newman.

United's shrewd Steve Stimpson gets credit for starting the "romance" business.

William Keighly and Genevieve Tobin recently eloped from Hollywood by plane.

Here is the finish of Mary Astor's "hushandless" flight. With her is Joe Lewis.

cided to surprise their friends.

This latter elopement was an expensive one for Mantz. The trip was made in a $10,000 Lockheed formerly owned by Amelia Earhart, to whom Mantz was technical adviser on all her flights. The plane suffered motor trouble and was forced to land short of its destination, in Imperial Valley. Mantz hired an automobile for the remainder of the trip to Yuma, then wired for another plane to fly down and pick up the party for the return journey.

In the meantime a desert "sand devil" —miniature whirlwind—picked up the disabled plane and tossed it in a heap of wreckage in a nearby gully. That's where the repair crew found it.

Cost to Tracy—$125.

Cost to Mantz—$10,000 plus!

To United Air Lines Agent,
Reno, Nevada.

In exchange for this order, please deliver to the bearer, arriving Reno Trip _____, date _____, a Class (A) - (B) wedding, $_____, including the following:

1. Automobile transportation to and from airports.
2. Two United Air Lines round-trip tickets to Reno.
3. Marriage License.
4. Services of Minister or Justice of Peace.
5. Lovely room in hotel in Reno, overnight.
6. Wedding dinner (for couple).
7. Breakfast (for couple).
8. Flowers for bride.

UNITED AIR LINES

By _____

Copies:
Original to couple.
2nd advance copy to Reno.
3rd copy to Reno with remittance.
4th copy to SF Traffic office.

Here y'are, lovers. This is the form United Air Lines uses for its weddings.

Then there was the hilarious early morning Lewis charter for a double elopement that didn't "jell." Joe was summoned from his bed by an insistent, if somewhat blurred voice demanding immediate transportation for four to Reno. A price was quoted and agreed upon and Joe hurried to the airport. Just as he was rolling his big cabin plane from the hangar, four unsteady figures loomed out of the darkness tugging at a heavy burden.

Two men and two girls gravely loaded a miniature organ into the plane as Lewis warmed the motor. They took off to the strains of gay swing tunes emanating from the back seat, where the musician of the crowd strove valiantly to be heard over the roar of the engine.

The resulting medley fell weirdly on the ears of the few ghost-like airport attendants who watched the plane lift toward the stars.

A double wedding was the general idea behind the trip, Joe gathered, with the organ a guarantee that the ceremony would be accompanied by proper music. The cool night air, however, induced a more sober consideration of the adventure and the music died out.

The quartet breakfasted in Reno and flew home again, the organ silent and the hum of the motor lulling all but Lewis to sleep.

The majority of wedding charters, Lewis and Mantz agree, are inspired by a desire to evade the California "three-day" law, to avoid publicity—or to get some. Lewis lists among his recent eloping clients Howard Lang, director, and Vicki Astlett, screen player; James Ellison, young star, and Gertrude Durkin; Jack Jenkins, Hollywood cafe owner, and Doris Dudley, actress; William B. Jones, prominent West Coast lumber man and socially prominent Anita Haskell; Phil Karlstein, director, and Dixie Martin, adopted daughter of Alexander Pantages, the late theater magnate; Manly Danforth, wealthy oil man, and Evelyn Hand, actress, and Manuel del Campo and Mary Astor, screen star.

Los Angeles and Hollywood newspaper men have long since learned to keep a wary eye open for sudden departures by Mantz and Lewis planes and, for that matter, for those of other well known charter pilots such as Bob Blair, Larry Therkelsen, Joe Plosser, Howard Batt, Ted Brown, Marion McKeen, Bud Ernst and a dozen others at fields close to Hollywood.

(Publicity men take very good care of the boys on the more prosaic elopements via scheduled airlines.)

One of the best stories to spring from this vigilance was the Mary Astor elopement—the now famous "groomless honeymoon." Lewis, again the aerial agent of Cupid, and Miss Astor collaborated in this bizarre episode which had half a dozen news rooms frantic for half a day. She had been much in the news because of a sensational and somewhat lurid court case, so when rumors spread that she was off to Yuma by plane reporters and cameramen flocked to half a dozen airports to keep watch for her return. Then mysteriously they gravitated to the field from which Lewis operates.

Sure enough, when the big white Lewis plane drifted to a landing, out stepped Miss Astor. She was followed by Lewis. The newshawks pressed closer. There was no one else in the ship!

"I never saw such a baffled crowd in my life," Lewis laughs. "One of the cameramen even cat-footed around the plane and peeked inside as if to surprise someone in hiding."

Miss Astor parried the flood of questions and led the crowd into the airport restaurant for coffee, where she finally admitted that she was again a bride, but refused to give details. All Joe would say was that Miss Astor had engaged his plane and that yes, they had been to Yuma and yes, he had been witness to a wedding and yes, he had promised Miss Astor he wouldn't say any more.

The gentlemen of the press had to be satisfied with those slender clues and it was only after extensive checking by the press wire services that they learned she and Manuel del Campo had been married in the privacy of the County Clerk's home at Yuma. Mr. del Campo had continued on from Yuma to his home in Mexico City.

Their honeymoon would have to come later, he said, when a press service reporter interviewed him at El Paso a full day later!

What amazes Lewis to this day is how the newspaper men got their first tip. Well, Joe, the answer is that you're a "doodler." You scribble names and figures and queer designs on your scratch pad when you are telephoning. A reporter at the airport on another story late the night before the elopement, dropped into your office to say hello. You had gone home. He used your phone and, being somewhat of a doodler himself, reached for your scratch pad . . .

Next time throw your "doodlings" away!

So this is the enchanting, spur-of-the-moment aerial marital adventuring that the airlines are invading with their all-expense weddings, matter-of-fact price schedules and Chamber of Commerce frills, is it?

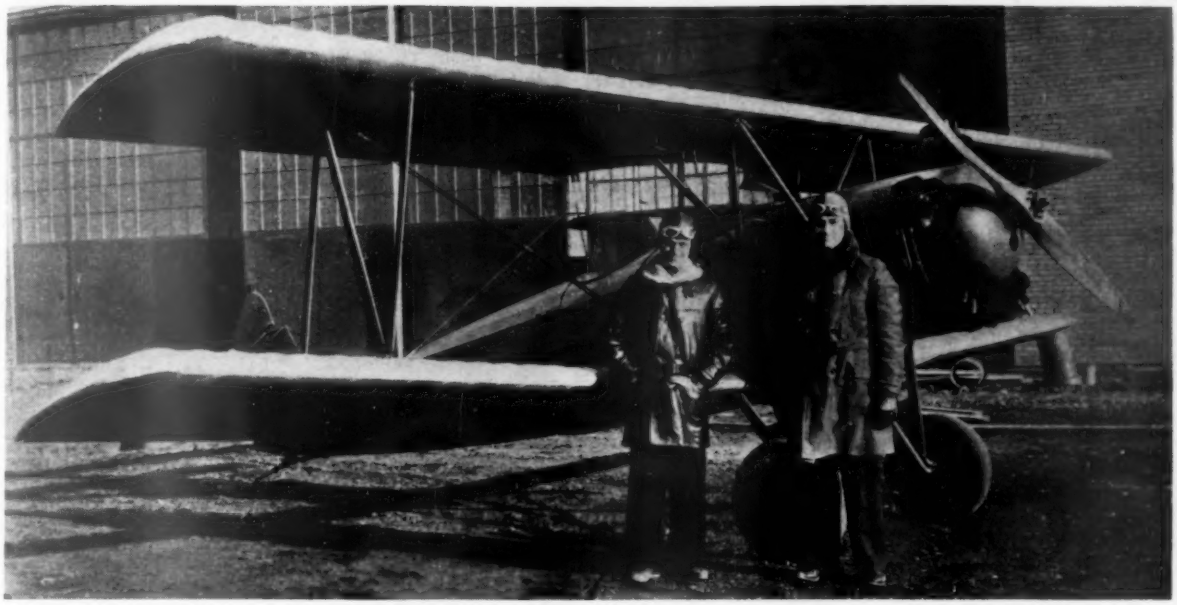
Blame Steve Stimson, alert United Air Lines traffic man at San Francisco—the same high pressure salesman who gets credit for thinking first of having pretty stewardesses aboard passenger liners.

Steve had no trouble filling up his transcontinental planes, but the San Francisco-Reno shuttle service was something else again—until he thought of the Nevada marriage laws. The result, so help us, is the slogan "Getting UNITED the Modern Way!" and two regular, for-sale-at-all-travel-agencies *all-expense* wedding tours from San Francisco to Reno and return.

Class "A" Elopement gives a couple air passage to Reno and return, transportation to and from airports, wedding license, minister, flowers and witnesses at a price of $60. Class "B" Elopement, listed at $75, includes the above plus a wedding breakfast or dinner for two and a room at the Hotel Riverside, Golden or El Cortez!

(*Continued on page* 85)

AVIATION NEEDS A 'MODEL T'



Lack of change has not hurt the sale of Fleets. The 1938 model is basically the same as 1930's.

by WILLIAM B. RYAN

We think the author has something here. Looking back on aviation's past, we'd say a "staple" ship is needed.

THE airport sages say that if two men were shipwrecked alone on a desert island, and each decided to set up in business, neither could get rich. No matter how much buying and selling was done, it would always have to be with each other, so that (barring the presence of a pack of cards) if one man had all the money, the other would have all the goods, and he would have to spend this money to get his own share of goods. Thus, their constant trading would merely be a form of amusement.

The airport sages liken the aviation industry to this desert island and the buyers and sellers of aircraft to these two men, showing how the industry's business has become stagnant simply because airplanes are always sold to aviation. This, like the desert island trading, is merely a form of amusement, they maintain, as it does not add to the wealth of the industry. Having delivered themselves of this analogy, the airport sages will strongly aver that aviation, to grow, must sell airplanes to new customers in large numbers. And this is very true indeed, but unfortunately, it is only an idea that exists in their minds, because they have never acted upon it.

The reason is, oddly enough, that they can't. More oddly still, the reason that they can't is that the modern airplanes in the popular price classes have not been evolved for *sale to people outside of aviation.*

Let's get that straight right from the start. There have been many airplanes which were primarily designed to be sold outside of the industry. The ships in the luxury class are, still. The lightplanes all came under that heading for, at first, the Aeronca *Cubs* and other little ships were sold almost exclusively to amateur flyers. Operators were prejudiced against anything that weighed less than 2,000 pounds, and wouldn't have them around.

Then smart businessmen began to put them on the line, selling time at half the former price and making more money. Aviation suddenly woke up to the fact that light ships were a profitable investment Aviation, rather than amateur flyers, bought light ships, and light ships changed almost immediately. One, which had been widely publicized as a "flivverplane," is now advertised as a business investment for the operator. Another very successful design was abandoned entirely because the Department of Commerce did not like its control system. This in spite of the fact that thousands of students were trained on such ships and the Department's dislike was purely theoretical.

Operators found that this ship was very satisfactory. The few amateur flyers who bought them raved over their adaptability to amateur needs. But the Department would not give flight tests in them, so the operators demanded a change. A change there was!

The light airplane has been developed in the last 18 months to meet operator needs, until it is light no longer. It is a

The old Travel Air (top) is as popular today as ever. But we need a standardized lightplane like the Aeronca (above).

sleek, shiny, attractive little thing which gives big-ship "feel" at about half big-ship cost. Students like its higher power, climb, speed, roomy cabin. Cross-country pilots are amazed at its range. But the man who first visioned it as the Model T of aviation knows that once again "progress" has run off and left aviation holding the bag—that in our haste to produce better ships, we have forgotten why we first produced them at all.

Aviation's history throws some interesting light on the fate of airplanes which are "developed" and the fate of those which are not. Among the world's successful airplanes, the Fleet is outstanding A high-priced trainer, it was sold in large numbers in the United States, is now being manufactured in Canada for sale to the British empire. The 1938 Fleet is the same airplane that was built in Buffalo in 1930, with only a few minor changes plus a recently adopted, new-style rudder.

Lack of change has not hurt the sale of Fleets. True, economic re-adjustment in the United States has narrowed the market for trainers in its price class. But the design is rapidly becoming a staple airplane in Canada, where it is sold not because it is cheap, but because it is good enough to compete with airplanes which have been changed every year. From this, it would appear that a good, proven design is not a thing to be lightly thrown off, merely for the sake of improvement. Isn't is possible that the Model T of aviation might have been a reality if improvement hadn't come along to bar its path?

The history of the great family of the Fokker D-VII provides an interesting example of how logical, precise, natural improvement occurs, and also shows what happens when a good design is abandoned. After a few years with the Army in this country, this German pursuit ship became the model (possibly because of its looks) for the first Travel Air. This was by no means a three-place Fokker as some say, for the wing was different, and construction naturally was not the same. But the basic idea was. From this source sprang that grand line of Travel Air "2000's" which covered this country and are still almost unbeatable for certain types of flying. Then came the "4000", a heavier ship which is hard to distinguish from its predecessor, but which was thought better adapted to higher horsepower. And from this evolved the *Speedwing*, the epitome of every small boy's ideal of an airplane.

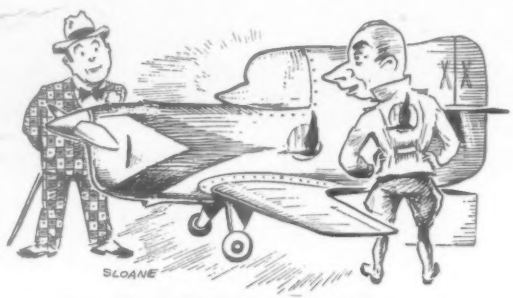
Then Travel Air was bought up by the Curtiss-Wright Corporation. This company streamlined the fuselage, put pants on the wheels and turned out a pretty, high-performance Travel Air called the *Osprey*, as well as a smaller modification for Cirrus, Kinner and Warner installations. Good airplanes, they were, all of them. The *Osprey* made an excellent, low-cost military ship, and was ideally adapted to some types of fixed-base operation.

But that was the end. Times were bad and Curtiss-Wright wasn't doing so well, what with its outlay in expensive airports that were not paying out. Today's *Cyclone* hadn't been invented yet, and today's Douglases hadn't been built to use them. The airplane market was in the doldrums.

So maybe there are a lot of reasons why the Travel Airs were abandoned by Curtiss-Wright. But it was certainly a slur at the reputation of this grand old line when the St. Louis plant began experimenting with a "modern", unproven metal design, which later proved highly unprofitable.

Logically, the boys around the airport will tell you, there should be Travel Airs today. They know that people don't like to fly old ships (as old as a "2000", perhaps), yet they are puzzled when the old ships fly into and out of fields that their modern equivalents wouldn't even look at!

Airplanes today are more comfortable than the ones built in 1928. They are faster and more economical. But the buying public realizes that weight for weight (and we still buy airplanes by the pound), they are not cheaper. It would be silly to blame the manufacturers for this. They have to stay in business, and the industry, which is their only customer, wants airplanes that are very much unlike the old ones for itself, though it would be very glad to sell any kind of a ship to the people on the outside.



"... It was designed especially for me ..."

The people on the outside want a ship that is good—safe, easy to fly—and cheap. They don't care particularly what it looks like. Ships that were good, safe and easy to fly were built 15 years ago! People wouldn't buy them because they were expensive. Factories couldn't build them cheaply because people wouldn't buy them.

Everyone in aviation knows the story of that vicious circle, and nearly everyone says that mass production will break it. This is not true, and will not be true as long as yearly changes are made in proven airplane designs. For though changing an individual airplane is a relatively inexpensive operation, setting up a production schedule for a new design as a costly operation.

Manufacturers will tell you it is an impossible dream, but the simplified, irreducible minimum airplane, devoid of everything but the ability to fly safely, is the only thing that will break this circle. For such an airplane (of proven design, remember) is the only kind that will ever be produced cheaply enough to interest the customer on the other side of the airport fence.

It is always unwise to compare aviation with the automotive industry without due consideration. Yet, if we are to strive for a Model T of aviation, we must remember the idea behind the Model T. It was, briefly, the furnishing of a minimum car to the American public until such time as the automobile became a necessity. Finer, better, roomier, faster, more expensive cars than the Model T did not effect its sale, for it was designed and built with mass distribution in mind and was a minimum car throughout its history.

The comparison is even more apt if we remember the way in which the Model T was developed from an awkward, squarish thing with a brass radiator to a little automobile with moderately current features. Yet it was basically the same at the end as at the beginning.

It is interesting to note that Chevrolet did not begin to cut into Ford's business, back in the twenties, until the larger, more "refined" Chevrolet was abandoned in favor of a little car that looked like a roller skate, cost about the same as a Ford and sported a gearshift. People made no bones about the fact that their flivvers and their Chevvies were not very good cars. They were better than no cars at all—much better.

It has often been said that the public would buy airplanes if they were made available at the public's price. A certain Mr. Vidal made such a statement once, specifying certain impossible performance features and an impossible price. The fact that he made such a statement has soured the aviation industry on people who feel inclined to suggest any move which might parallel his, no matter how unlike Vidal's it may be.

However, in the airplane that resulted from the poorly thought-out Vidal statement one important thing—some believe it was the *most* important feature, despite all price talk—was an airplane with just about every safety feature known to aeronautical science: the Stearman-Hammond. An airplane like this might well be aviation's much-needed Model T. Literally anyone can fly it. But the aviation industry used Vidal's $700 statement as the excuse to blackball and ridicule the ship from the beginning. Actually, the airplane took all the glory—on which so many professional airmen dote—out of being a pilot . . .

Yet at the risk of being classed with Vidal as an impractical dreamer, one must admit that the simplification of modern, light airplanes, which are safe enough for any practical purpose, would go a long way toward producing the airplane that the public (not aviation) wants. And the history of aviation, as we have reviewed it, should tend to show that the continual changing of airplane designs, while it may lead to advancement in the ships themselves, is detrimental to the progress of aviation as a whole.

END

Our Airlines are SAFE!

Says **MAJOR R. W. SCHROEDER**
Vice President, United Air Lines

The author, famous in American air transportation, answers those skeptics who have distorted airline problems.

IN order to review the safety trend in air transportation, we must go back to the Wright brothers, and briefly follow the trend up until today. The Wright brothers were confronted with the same hazards and enemies of flying that confront us today, such as gravity and weather. We know that they did conquer some of these so-called hazards by avoiding all that they could in that first flight. We further know that most of the hazards have been conquered, and no form of transportation, on land, sea, or air, is even today immune from accident. Those that we cannot conquer, we set up means to avoid them.

Let's review what has been done to conquer these retarding factors to safety. First there is gravity. The Wright brothers overcame it on the first flight for less than one minute by the use of all the power they had available. Today we fly great distances, safely and efficiently, with 55 to 65 percent of the power available, and think nothing of gravity, though we still use gasoline for power.

Gravity had been conquered by the power of the gasoline engine. Now let's see what the Wrights did about flight in darkness or unfavorable weather conditions. They conquered these by waiting until daylight and for a day when these other factors were not there to hinder them or affect their safety. They avoided them. So darkness was conquered by flying in daylight. Today we think nothing of darkness, though it was ten years before man successfully flew in the darkness and thereby substantially conquering it, although many of the airplane accidents occur during hours of darkness. Indicative of the technical advance which has been accomplished since the Wright brothers' success is the steadily lowering insurance rates for air travelers. Leading insurance companies have now put air travel on a comparable insurance basis with more established forms of surface transportation. Still, we will always discuss safety trends in air transportation with a view to further increasing the safety and efficiency of our operations.

In any form of transportation the machine is usually more developed and perfected than the man; he must learn what and what not to do with the machine; his skill, knowledge, and judgment come only as a result of his training, practice, and experience. Therefore, we see to it that he does learn how if we are to depend on his judgment, skill and knowledge.

When I refer to "man," it not only includes the pilot, but also the crew and/or others who operate the airplane and its equipment in the air, as well as the equipment on the ground, such as has

The author (above, right) is shown in his early days, when flying really was dangerous.

to do with the safety and navigation of the airplane in the air. When I refer to "machine," it includes the airplane and its equipment, used both in the air and on the ground for the purpose of safety in air navigation.

The machine and its equipment used in the air, as well as the equipment on the ground, are all definite, tangible things which the airlines build for a purpose—they know a lot about them; they understand how to build them and with a high factor of safety. They also know how to use them with a large margin of safety.

However, if we use the machine to its ragged edge of safety, there is no margin of safety left. Airlines deal now with the human factor, an intangible factor; the pilot is, therefore, a vital factor.

All men do not think and act alike. There are many ideas of what safety is. Safety is the result of the combined effort of the man and his machine against the elements, the elements being the contributing factors or causes in most accidents. It can also be said that these elements are the retarding factors to greater safety. My past experience in the investigation and analysis of airline accidents has always been with the one thought in mind, and that is, "Was it man or machine that failed?"

I think we should look at it just that way because that is what our business is based upon. That is the business we are in, whether we like it or not, it is the business of man and machine versus the elements that may create conditions of unsafe flight.

It is true and fortunate for us that man and machine win practically all of the conflicts with the elements. It is when the man and machine do not conquer, that we may have the accident. We have to depend more upon the pilot than many people believe.

When I started in this business, I said that safety was a function of the man and his machine against all the hazards to safety; that all equipment used in the airplane and on the ground in the form of aids to promote safety, are merely aids and in no sense are they guarantees of safety.

I further believe that if we have to produce air transportation for complete public acceptance we must make it safer; that if we were to make it safer we must, if possible, improve the machine and all of its equipment—both that which is used in the air, and that which is used on the ground, as aids to safety.

We went from single engine aircraft to multi-engine aircraft so that we could continue flight in the event of an engine failure. In other words a standby engine, a spare, an out, for the pilot.

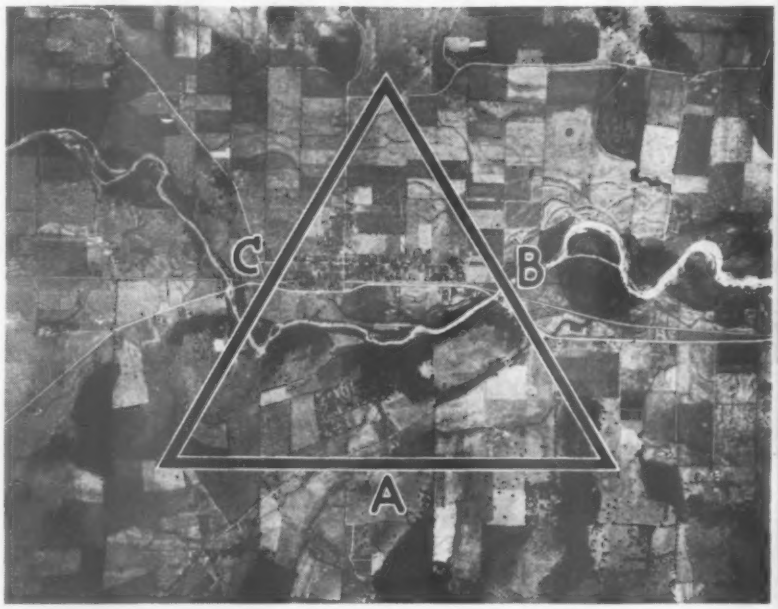
We have placed two pilots in the cockpit. Two men are better than one, so again we have provided a standby.

We have provided for a standby fuel supply (a minimum of 45 minutes) with a rule for its use.

We have provided for standby flight instruments, standby radio range beacon

(*Continued on page* 84)

What's the Answer?



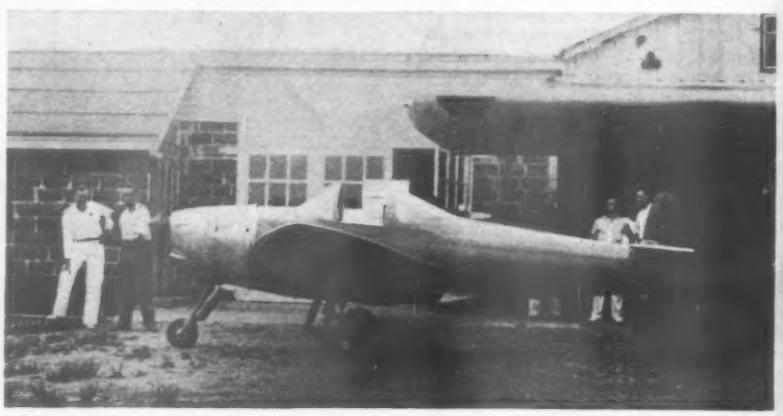
IF you answer this problem within five minutes you are unusually clear-thinking and sharp-eyed. It's not a gag and there are no strings attached to it; the entire problem is right here before you.

Now: the triangle shown above is a triangular course flown by a certain airplane. The pilot takes off, climbs to a given altitude and heads for the course. Remember these facts: on all three legs of the course the plane maintains the same altitude. The percentage of horsepower drawn from the engine is the same on all three laps. The wind—from all directions—is zero m.p.h.

Starting on the lower left-hand corner of the course, the pilot flies Leg A in exactly 80 minutes. He banks and flies Leg B in the same time: 80 minutes. He banks again and flies Leg C—but it takes him 1 hr. 20 min. Now, check the above facts carefully again, then see if you can tell why there was that difference in time on Leg C. Don't feel particularly bad if you can't get it; dozens of airline, Army and Navy pilots actually failed to get it, although it's really simple. If you figure out a solution, we'd like to see your results on a penny post card.

A New Three-Wheeler

A RECENT, newly-developed small ship is the unusual little monoplane shown below. Little technical information concerning it is known at this writing. However, the new design follows the current trend favoring tricycle landing gears and twin-ruddered tail assemblies. According to POPULAR AVIATION's correspondent, the ship is being developed by Washington, D. C. engineering firm which also has developed the four-cylinder, air-cooled inline engine with which the ship is fitted. The ship will carry two persons side-by-side.



This stewardess got a surprise when she asked to see Mrs. Hager's ticket. Covering 13 airlines, the ticket was almost seven feet long.

80 = 60 + 20

I FLEW FOR A WEEK

by ALICE ROGERS HAGER

Offhand one would think this flight sheer ballyhoo. But consider that the author traveled in comfort and on regularly scheduled airlines.

ALICE ROGERS HAGER is one of this country's most unusual aviation writers, has been at it several years. When she's not flying about the country on some ambitious aeronautical project, Mrs. Hager can be found in Washington, D. C., her home. She is an able feature writer who specializes in aviation simply because she loves it.

WE have a new national disease—The Week. There are Eat-More-Fish Weeks and Write-Home-to-Mother Weeks and See-Your-Dentist Weeks, and all of them add up to about 150 percent of the available time during the year. So definitely national as they that down in Cuba the other day, during the trip I am about to describe, an estimable Cuban gentleman whose willingness to understand what I was trying to tell him was badly impeded by his sketchy English, asked plaintively after half an hour of futile explanations on my part, "But Senora, what is a *Week?*"

When it was all over, I was in a position to be able to answer that question. Perhaps a few statistics here would help. At the beginning of National Air Travel Week (Saturday morning, October 1st) I left Newark airport at 12:25 a.m. for points West, North, South, East, and so on. Yes—literally. On Sunday evening, October 9th, I returned to Newark at 6:55 p.m., having flown in the meantime exactly 18,708 miles. I was gone eight days, 18 hours and 30 minutes. But out of that, I had spent three full days on the ground, not counting short station stops of 10 minutes or so. My actual elapsed flying time was approximately 130 hours.

This aerial trek had included two round trips to the Pacific coast and three zigzags border to border, ranging from Los Angeles to Seattle, Fort Worth to Detroit and Montreal to Havana.

By want of contrast, Howard Hughes' magnificent flight around the world covered 14,716 miles in 91 hours, 41 minutes and 10 seconds. I flew 4,000 miles farther in an additional 38 hours. The only significance in the comparison is that I did my journeying on scheduled planes that anyone can use, making connections between 13 different airlines. It took three years to prepare for his single difficult flight. Behind my comfortable Odessey, there had been ten years of building day by day by thousands of men in every phase of aviation.

But coming back to this business of The Week. When National Air Travel Week was proposed, along with a lot of other people, I felt that it was being planned too soon after National Air Mail Week. I was exceedingly dubious of either its wisdom or its necessity. It seemed repetitious to say the least. To be sure, it would be celebrating the tenth anniversary of the real beginning of passenger travel by air in the United States—and that was momentous enough, considering what had taken place aeronautically between 1928 and 1938. But wasn't there some other way of doing the job than this one of crying up and down the marketplace for seven days along with the worthy gentlemen who sold finny provender from the ocean depths?

I'm breaking the silence that usually surrounds such preliminary doubts now, because I found out just how wrong I was, and knowing about those others who were also in the Apostle Thomas class, I want to share my findings with them.

When my telephone rang one morning just before the Cleveland Air Races and "Pat" O'Malley (then of American Airlines and now of the Civil Aeronautics Authority) said to me by long distance from New York, "How would you like to go out and fly the country during Air Travel Week?" I answered weakly, "What do you mean, fly the country?"

Mrs. Hager literally lived aboard airliners, pausing only moments at airports.

Pat said, "Just that—start out the first day and end up the last and go on as many airlines as you can cover in that time."

I began to see the dawning of a grand idea. "You don't have to ask me twice," I told her. "When and where do I start?"

Before long, other friends were telling me it wasn't a question of where I started, but of how I would finish. They even asked what kind of stretcher I wanted waiting when I got back to the home airport. As a matter of fact, when I reached Newark on October 9th, at jour-

ney's end, I was considerably less tired than the Air Travel Week committee that had been monitoring the trip from the ground. They had had all the work to do. I'd had all the fun.

But that's getting ahead of the story.

The principal thing about the whole idea was that it should not be regarded as a stunt. In ten years of heroic effort, aviation had joined the adult industries in the United States. Few people among the general public realized just how adult and here, it was hoped, was a way to bring the fact home to a few more. If a woman with more gray in her hair than she cared to admit, and a family nearly grown, could go out as any normal traveler would, and on scheduled transport planes cover every section of the country without undue difficulty or fatigue, then perhaps some of the people who still look upon flying as an adventure in reckless courage or just plain foolhardiness might come to their senses and begin to regard it as another ordinary means of getting from one place to another.

For the sake of the record, it should go down here that, although I've been writing nothing but aviation for some years now and had flown over 150,000 miles as a passenger before this trip, I came back with a new and even more vital respect for what had been achieved during the decade in question.

Like any ordinary trip, there were details to be arranged before the start. It may be of interest to know that a prize was offered by the committee in charge to the traffic man who would present the most comprehensive itinerary. Even though the final one made up did not absolutely follow the best selected, suffice it to say that there was keen interest and rivalry over it and one clever young man was rewarded. They also had it figured out that, as compared with the current cost of my ticket—$1,300—such a trip, if it could have been made in 1928, would have totaled the staggering sum of $14,000 at the rates then prevailing.

Every effort was made to be considerate of my comfort. It took some tricky planning to see that the nine nights en route had as many sleeper services as possible. It worked out with four sleepers, two day planes with deep reclining lounge chairs and two hotels—a very fair average.

The itinerary itself presented great variety, both from the standpoint of seeing the country from the air and from that of getting acquainted with as many different lines as possible. Here it is, believe it or not:

Lv Newark, N. J., via TWA	12:25 a.m.	Oct. 1
Ar Oakland, Cal.	7:13 p.m.	Oct. 1
Lv Oakland via United	2:16 a.m.	Oct. 2
Ar Seattle, Wash.	8:13 a.m.	Oct. 2
Lv Seattle via Northwest	8:30 a.m.	Oct. 2
Ar Chicago, Ill.	10:50 p.m.	Oct. 2
Lv Chicago via TWA	11:55 p.m.	Oct. 2
Ar Newark	6:04 a.m.	Oct. 3
Lv Newark via Canadian Colonial	8:45 a.m.	Oct. 3
Ar Montreal	11:15 a.m.	Oct. 3
Lv Montreal via Boston-Maine	3:41 p.m.	Oct. 3
Ar Boston	5:56 p.m.	Oct. 3
Lv Boston via American	7:00 p.m.	Oct. 3
Ar Newark	8:40 p.m.	Oct. 3
Lv Newark via Eastern	9:00 p.m.	Oct. 3
Ar Washington	10:20 p.m.	Oct. 3
Lv Washington via American	10:35 p.m.	Oct. 3
Ar Fort Worth	5:50 a.m.	Oct. 4
Lv Fort Worth via Braniff	6:45 a.m.	Oct. 4
Ar Houston	8:50 a.m.	Oct. 4
Lv Houston via Eastern	11:05 a.m.	Oct. 4
Ar Atlanta	4:25 p.m.	Oct. 4
Lv Atlanta via Eastern	4:50 p.m.	Oct. 4
Ar Miami	11:00 p.m.	Oct. 4
Lv Miami via Pan American	8:00 a.m.	Oct. 5
Ar Havana	10:30 a.m.	Oct. 5
Lv Havana via Pan American	3:00 p.m.	Oct. 5
Ar Miami	5:15 p.m.	Oct. 5
Lv Miami via Eastern	9:00 p.m.	Oct. 5
Ar Washington	4:00 a.m.	Oct. 6
Lv Washington via Pennsylvania-Central	8:30 a.m.	Oct. 6
Ar Detroit	12:06 p.m.	Oct. 6
Lv Detroit via American	4:15 p.m.	Oct. 6
Ar Chicago	5:00 p.m.	Oct. 6
Lv Chicago via Eastern	6:45 p.m.	Oct. 6
Ar Atlanta	11:59 p.m.	Oct. 6
Lv Atlanta via Delta	7:00 a.m.	Oct. 7
Ar Jackson	9:54 a.m.	Oct. 7
Lv Jackson via Chicago & Southern	10:02 a.m.	Oct. 7
Ar St. Louis	1:16 p.m.	Oct. 7
Lv St. Louis via TWA	2:06 p.m.	Oct. 7
Ar Kansas City	3:41 p.m.	Oct. 7
Lv Kansas City via Mid-Continent	10:00 p.m.	Oct. 7
Ar Omaha	11:20 p.m.	Oct. 7
Lv Omaha via United	12:09 a.m.	Oct. 8
Ar San Francisco	8:15 a.m.	Oct. 8
Lv San Fran. via United	5:00 p.m.	Oct. 8
Ar Los Angeles	7:21 p.m.	Oct. 8
Lv Los Angeles via American	10:30 p.m.	Oct. 8
Ar Newark	6:55 p.m.	Oct. 9

"The plane to Kansas City? That was at Gate 7!"

As will be seen from this, the making of certain connections was vital if the entire itinerary was to be completed. Every day in New York, the committee had an alternate plan arranged if anything went wrong. The remarkable thing was that not one slip occurred; not once was I delayed by weather or failure to meet schedule. The only near thing was in the Seattle connection, which was a matter of minutes and where an entire day would have been lost if I had not made Northwest's morning ship.

That trip up from San Francisco was also the most exciting of the week. Leaving Oakland at 2:16 a. m., we very soon picked up a tail wind that was really something to write about. Its top force was 100 miles per hour and before we knew what was happening, our Douglas was doing 275 m.p.h. Tony Le Vier won the Greve race at Cleveland with an average of 250.881 and Roscoe Turner's average for the Thompson, a new record, was 283.419. So our transport wasn't doing so badly.

The catch about Seattle lay in the fact that a heavy fog had shut the airport in completely and unless it lifted in time, we would be grounded in Portland. As it was, we were in so far ahead of time in that city that the stewardess took us all in to town for breakfast. There were a few anxious moments when we came back before the welcome radio message came through that the fog had blown over and that Seattle was O. K.

Radio in all its aspects played a big part in the trip. Most people know from experience the way in which radio works and have a vague idea how it ties in with flying. I couldn't help remembering many times, either on the planes when the stewardess would come back with the frequent logs from the cockpit, telling us what report point we were over and where our next report to the company ground station would be given, what I had heard on my first transcontinental trip. That was nearly nine years ago—48 hours coast to coast with two nights spent on trains because there was no night flying. The two days were passed in a nice noisy Ford tri-motor, with cotton in our ears, bucket seats to squirm in, and on apple and a ham sandwich for lunch. One pilot told me then that some remarkable work was being done on two-way radio telephones, which they hoped would be good enough for ship use before many years had passed, and this came to pass.

That radio telephone, long an accom-

(*Continued on page* 89)

PLANE LIGHTNING

The Army's new Curtiss P-40 fighter is said to do 400 m.p.h. with its 2,000 h.p. Allison engine.

These are just part of one club's members on a Chicago airport tour.

Aviation Jr.

The youth of America mean more to aviation than the aviation industry wants to admit. Newspaper "flying clubs" are concrete proof of that.

By
MAURICE RODDY

MODEL airplane flying is definitely no longer in the "toy stage" but has mushroomed, like its big brother commercial aviation, into a million dollar industry and one of the nation's most competitive sporting events.

In addition model flying has developed an unsuspected military value and serious consideration is being given to the possibility of using gas model planes for target practice. Military eyes are also still viewing the experiments being conducted with radio-controlled models.

According to Maj. Clifford A. McElvain, distinguished World War flyer, model building and flying contributes much to national defense in the development of new ideas and building young America; tomorrow's pilots and air personnel. Several national surveys have established the fact that boys and girls interested in model air activities are nearly all Grade A pupils. The same surveys also showed that among boys aviation rated first and with girls it was eighth choice for careers.

Much credit for the recent tremendous increased interest in model aviation may be attributed to magazines like POPULAR AVIATION and the great metropolitan newspapers which have sponsored junior aviation organizations. Instant success has met the creation of these groups which in most cases have been immediately sanctioned by the National Aeronautic Association.

Highly illustrative of successful newspaper promotions in the field of junior aviation are the programs of the Chicago *Daily Times* and the Scripps-Howard chain, whose "Junior Aviators" number

Roscoe Turner (second from right) is an enthusiastic club booster.

thousands. There are also many similar organizations fostered by other big, independent newspapers across the country.

The Chicago *Times* program was launched during the International Air Show which was held at the International Amphitheater last year and, although not a year old, has a membership of more than 40,000 boys and girls. Included in this membership are units from Morgan Park Military Academy, Calumet High School, and Sons of the American Legion posts. The national commander for the Sons, Joseph Dorfman, hails model airplane training as a major function in youth training and a most important national movement. Commander Dorfman has repeatedly expressed these thoughts in radio and newspaper interviews. Recognizing the basic national defense angle in connection with junior air activities, the American Legion sponsors a national annual model airplane contest at Indianapolis. Approximately 50,000 spectators attend the yearly event.

However, from a contestant's standpoint, the most important annual meet is the national championship contest staged at Detroit. This event has been sponsored by the Exchange Club and sanctioned by the NAA. It is rated in the junior field of aviation with the same emphasis as the National Air Races are in the adult field. During the 1938 meet more than 1,000 contestants participated in the three-day competition which was staged at Wayne County airport. At the conclusion of the contests, Milton Huguelet, a member of the Chicago *Times* organization, was declared national champion.

International atmosphere is injected into the Detroit meet with the Admiral Moffet contest and the Wakefield International Competition eliminations. Six highest average times determine the six American contestants eligible to compete in the Wakefield contest which is held annually in the country that won in the previous year. Models entered in the event must comply with the fuselage regulation as outlined in the Admiral Moffet contest rules. These requirements were that models shall be of the cabin design with built-up, closed fuselage and shall resemble man-carrying aircraft. Minimum area of the maximum cross section corresponded to the formula L 2/100 where "L" equalled the over-all length of the model, excluding the propeller. Fuselage also had to be of approximate streamline form with at least 90 percent of its surface covered. Any type of power was permitted except gas.

Moffet contest models were also required to have a wing area of not less than 100 square inches and not over 200 square inches and weigh 3 ounces for every 100 square inches of wing area. In addition they must be rise-off-the-ground type with landing gear permitting a standstill take-off. Wheels must turn freely with a diameter of not less than 1½ inches.

Six highest duration flights made by Canadian entries and six similar flights made by the United States comprise the Canadian and U. S. teams for the Admiral Moffet International Contest, and only members of such teams are eligible to compete in this event.

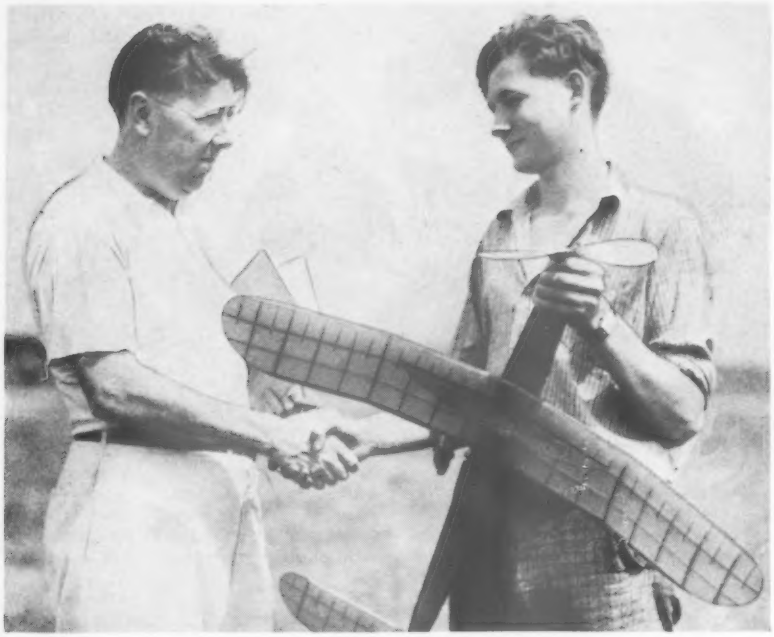
Besides the standard built-to-scale models flown at all regular model meets, there are many original designs. Models in this classification are not "over-night dreams" but represent in many cases more than a year's endeavor. Two years were spent in the development and construction of the first successful radio-controlled model which furnished one of the main features during the recent national championship meet in Detroit.

Stressing the big business angle connected with model flying, LIFE magazine some issues ago devoted several pages to the subject declaring that gas model flying alone represented a $2,500,000 industry. Other published statements gave total annual figures for all model flying activities as $75,000,000. This figure, of course, includes factory investment, personnel pay-rolls and retail stores throughout the nation. However, it is still a staggering amount for something that has generally been regarded as a toy.

Since model flying entered the big-time stage, the National Aeronautic Association has established rules and regulations governing all gas flying, and "pilot" licenses are issued. Contestants under 16 years of age are only allowed to fly gas models under the supervision of NAA contest directors. Further evidence of the importance with which the NAA regards the model field is contained in the fact that the association's official publication now contains a department devoted exclusively to junior aviation.

Discussing the sportsmanship of model "pilots," Col. Roscoe Turner declares that they are made of top-flight material winning their contests clean and losing without "welching." When it comes to the question of sportsmanship, the colorful colonel should know, for he was taking it on the chin for quite a time until he winged his way to a second Thompson Trophy victory and also established a new world's record for the course.

Airline officials can always spend their spare moments showing boys' clubs around.



The author (left) is head of the thriving junior aviation department of a Chicago newspaper. He is shown congratulating one of his "cadets" on the latter's model.

Capt. Eddie Rickenbacker, America's war ace and president of Eastern Air Lines, is another world famous flyer who enthusiastically approves of air training for youth. It is Rickenbacker's opinion that such movements are the foundation for the future of military and civil aviation. Concurring in this expression are also such noted pilots as Maj. Jimmie Doolittle, Jack Knight of United Air Lines, Commander Charles E. Rosendahl, Al Williams, John Collings of TWA and M. D. "Doc" Ator of American Airlines.

Among today's greats in aviation who were former model builders are Maj. R. W. Schroeder of altitude record fame; Walt Addems, chief pilot for United and William B. Stout, founder of one of the nation's first model clubs, which is still in active existence. This organization is known as the Illinois Model Club and has its headquarters in the Auditorium hotel, Chicago, where it has been located for more than 10 years. Other nationally prominent clubs include the Aeronuts, Chicago Gas Model Aeronauts, Penguins, Helions and the Buzzards.

These organizations hold regular meetings and election of officers. Open forums are also held for the purpose of exchanging ideas and possible changes in rules governing competition. Contest trophies adorn all club quarters denoting victories in meets across the country. More than 20 world records for model competition in all classification are held by the Aeronuts, which is an international mark in itself.

Some of the more advanced junior aviation clubs sport special uniforms. In this particular group are some girl members. The stewardesses (right) were special guests.

Recreational directors in the U. S. recognize the ever-increasing importance of junior aviation as a subject matter and cooperate to fullest extent with all such programs. Competent instructors and field-house facilities are made available. Probably the most extensive program of this nature exists in Chicago under the direction of Walter Wright, superintendent of the city parks and aviation.

Many other cities have followed the Chicago plan in handling aviation as a recreational project and have established neighborhood field-houses in all sections, making it extremely convenient for youngsters to attend classes. Instruction periods are scheduled during morning, afternoon and evening hours. Accordingly, even working youngsters have an opportunity to study. Beginners are usually termed "wood-butchers" and assigned to simple glider instruction and construction. Later, they enter the rubber-band class. By this time they are fully sold on model flying and it isn't long before they are in the "big-league" of gas model design and competition.

Last June the Bram stores of Gary, Ind., sponsored a gas model meet for northern Indiana. In explaining the purpose of the event, it was pointed out as "something new under the sun for the benefit of the interested spectator" that was rapidly growing into "America's greatest hobby."

Estimates at the time listed approximately 50,000 expert model builders in the U. S. The Bram meet attracted thousands of spectators and was covered by both newspapers and newsreel companies. As a result the Northern Indiana Gas Model Club was immediately organized and Bob Roberts is its present contest director.

Air shows sponsored by junior aviation movements have been attended in eight cities by 540,000 people; an average of 67,500 per show, which shouts out loud that model flying is here to stay. When the junior national air races were held in Buffalo, President Roosevelt wired his endorsement of the program and its contribution to the future of American aviation.

Educational aviation programs for youth as conducted by most newspapers are not limited to model building and flying. As a rule they cover all air subjects and in reality offer a complete ground correspondence school course. Membership application blanks require that applicants denote the subject preferred such as radio, navigation, meteorology, administration, traffic (etc.). In addition to the preferred subject, the new member must take three compulsory subjects as prepared by the publication.

(*Continued on page 78*)

REMEMBER the 'BULLET'?

by RALPH N. MILLER

Though the ship was branded as a killer in its time, the Bullet was a pioneer in a branch of construction that today is dominant.

PLANES and pilots have changed a lot since the Twenties. Perhaps you have noticed it, too. If not, glance back ten years and recall how the wings of most planes rode high above the fuselage.

Now, fuselages ride above the wings of practically every type of land aircraft except the lightplane. As a result, American aviation itself is riding high—higher on a whole than that of any other country.

It would take a fat book to describe how this supremacy came about. We read in the newspaper sequels—such as the swift dash of Howard Hughes around the world—the pace-setting standards of American military and civil aircraft and the top-dog performance of Russian copies in Spain.

Of course most of the brilliant but loosely disciplined pilots of the Twenties are strewn along the trail of the old-time western gunmen. They became "uneconomic." Big Business—represented by our highly efficient airlines—found them prone, in fact, too eager to take chances. Business prefers flyers who are systematic souls of discretion. But, for all that and in spite of being a modern misfit, many an old barnstormer of the Twenties could fly figure-eights around the average airline pilot of the hour. The best of the "feel fliers" were living proofs of the Darwinian "survival of the fittest." To locate many of the brotherhood today, one must visit modern Spain, Mexico, China, and perhaps a few scattered fields in this country. . .

This story deals primarily with Al Mooney, an Irishman. He was born in Denver, Colorado, in 1907. Celtic genius has a habit of flowering early. In 1928, at the age of 21, Mooney designed the forerunner of many of the American ships which are now the finest heavy bombers and airline transports yet developed. Aided by the Corrigan-kind of pilots who flew because it gave a lift to life in every sense of the word, Mooney handed American aviation a fillip similar to that which the clipper ship contributed to our merchant marine of its day.

In a way Mooney resembled many a scientific entrepreneur who is now a name in the text books. His chief contribution to his field lay in shattering an established but phoney theory—one that was gospel to most of the aeronautical engineers of the day—and some aeronautical engineers can be as sheep-minded as any other kind of specialist. From the World War to the advent of Mooney's master creation—the *Bullet*—men of the drafting board largely believed that the main way to build more speed and performance into an airplane was to crowd on more horsepower. The *Bullet* proved unequivocally that the super-clean, streamlined design made each "horse" do the work of a team. It was turned out by the now defunct Alexander Aircraft Company of Colorado Springs, and the Alexander company gambled its capitalization, its future and its hopes in a vain effort to succeed with a ship that was five years ahead of time.

However, in the process of going broke, President J. Don Alexander touted the advantages of the *Bullet* design to the point that it became a constructive nettle under the tail of the

(*Continued on page 76*)

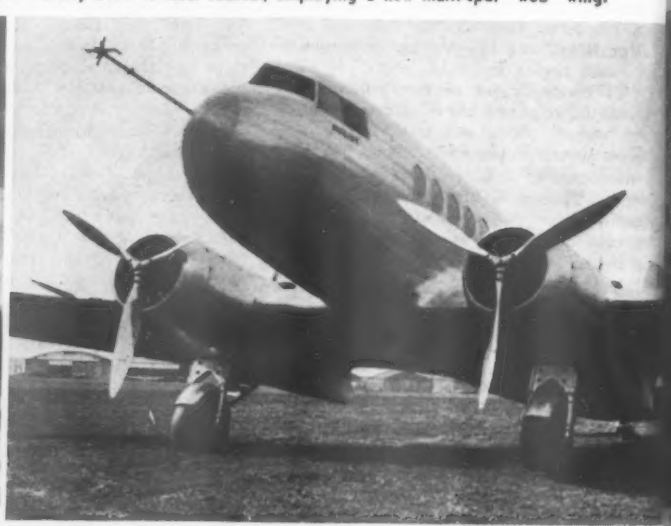
Above and below are three stages in the efforts to wipe out the Bullet's jinx.

LOOK-ALIKES

The pictures on these pages even surprised the editors when they were finally assembled. Have you any others?

The above three American transports are strikingly alike in outward appearances. From top to bottom are the Lockheed Electra, Barkley-Grow and Beechcraft. Of the three, the Barkley-Grow is most radical, employing a new multi-spar "web" wing.

The airplanes across the bottom of this and the opposite page look like the DC-3 (above) or its preceding DC-2.



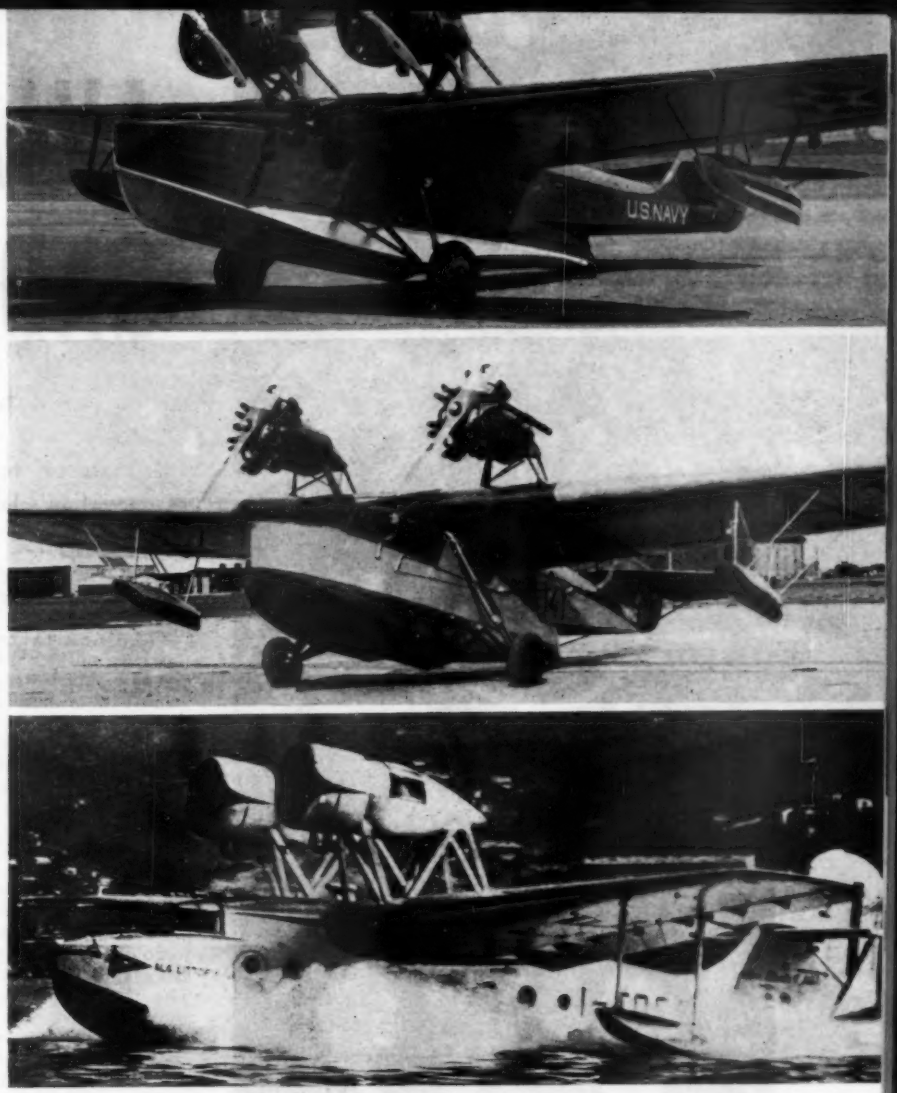
Compare the many basic details of the French Breguet Fulgur (above) to the American DC-3. Note similarity in landing gear and fuselage.

YOU'VE heard of airplanes that seem to be copies of one particularly popular design. Now you can look at some. But when we dug into POPULAR AVIATION'S voluminous photographic files we got an even greater surprise than originally anticipated. Just a few of the photographs we came across are shown on this and the opposite page.

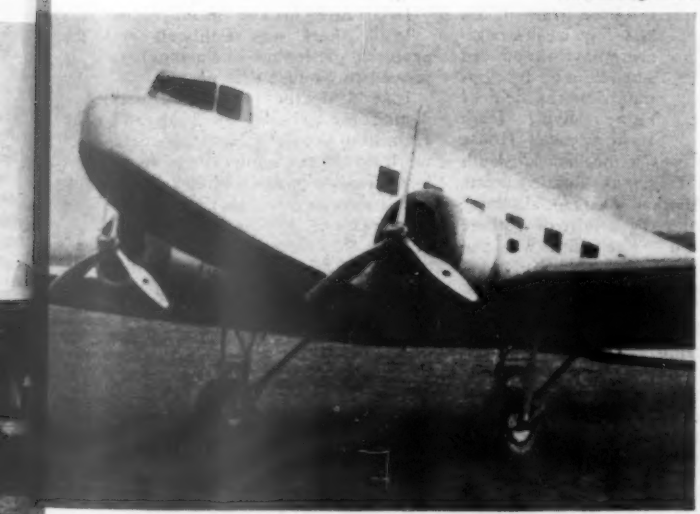
To assemble the pictures shown here, we based our search on three original American designs: the Lockheed *Electra*, Douglas DC-3 (or DC-2) and the Douglas *Dolphin*. Each of these ships was the first ship of that design we have seen. The surprises came when we started to match them with "look-alikes".

The *Electra*, you can see, has some surprisingly identical twins in the Barkley-Grow and Beechcraft. In this particular instance, all three ships are American. Greatest outward difference between the three is that the Barkley-Grow has a non-retractable landing gear. Of course, the ships differ quite a bit in power, construction and performance. But they are definitely look-alikes.

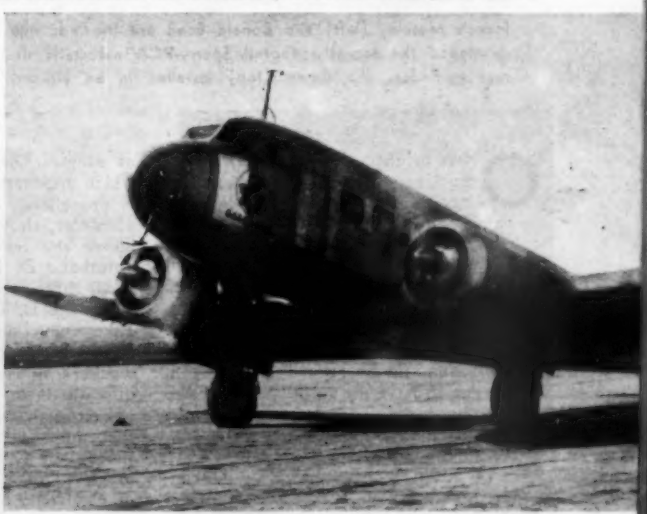
The Douglas DC-3 seemed to draw the largest number of imitators, all of them overseas. In France, Breguet produced his *Fulgur* and Marcel Bloch got out his "220", several of which are being used today by Air France, the national airline. That the Italians liked the Douglas design was proved by the Fiat G-18. The similarity between the American Douglas *Dolphin* and the Austrian Hirtenberg HA-11 also was very striking. And the Italians evidently liked the *Dolphin's* layout, as evidenced by the Macchi C-94. Watch for More Look-Alikes next month.



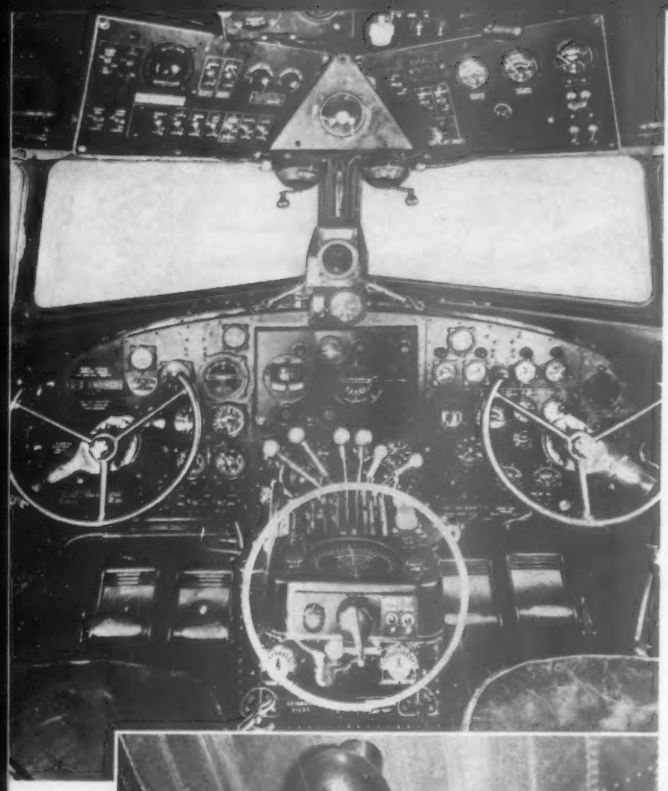
Of the three look-alikes above, the American Douglas Dolphin is the first to be designed along those lines. Directly underneath the Navy's Dolphin is the Austrian Hirtenberg and the Italian Macchi. The Austrian ship is the most striking duplicate.



Surprisingly similar to the Douglas DC-3 is the Italian Fiat G-18 above. It is powered with two 1,000 h.p. engines and carries 18 passengers.



Comparable in power and performance to the DC-2 is the Bloch "220." This is a standard French transport ship.



Francis Moseley (left) and Donald Bond are the lads who developed the recently-adopted Sperry-RCA automatic direction finder. It's shown (top) installed in an airliner.

AVIATION'S GADGETEERS

by DONALD FROST

Hats off to the men who putter around aviation's laboratories. They've earned it.

ON A bright autumn day in Indianapolis, a little more than a year ago, a man sat in the cockpit of an airplane rubbing his chin thoughtfully. In front of him was a gadget called a flight ray. The flight ray worked all right but his orientation problem was a horse of a different color.

"Remember," he finally remarked to a fellow beside him, "the idea we had for an automatic direction finder? Well, we've got to have an automatic D. F. to make our blind landings simpler with the flight ray."

He slapped his knee.

"I've got it!"

He raced off to town, returning an hour later with an assortment of stuff which looked as though he had raided a junk yard. Included in it was an old motor which had been part of a Ford windshield wiper.

Then and there was born the world's first automatic instrument with a needle which pointed unerringly toward a radio station regardless of the position of the airplane which carried it.

Making something out of nothing, achieving new safety in the air with no more than a theory to go on, isn't always as simple as that. The story behind aviation's inventions, the developments which make flying safe for you and me, usually are the product of sweat and ingenuity —over a long number of years.

Three times in the last few weeks engineers have announced striking developments in the field of safer flying, fresh from science's House of Magic. One was a mechanical sleuth which discovers dangerous vibration points in propellers. Another was an "absolute" altimeter, showing the height of a plane above the terrain. The third was the automatic D. F.

All three were "in the works" for years. Even the D. F. had existed in formula. Like every other invention, they were suspected of being possible. Research workers, in fact, are the most suspicious individuals in the world.

Before that day in March, 1876, when Alexander Graham Bell first sent his voice over a piece of wire, he had stated his problem: "If I could make a current of electricity vary in intensity precisely as the air varies in density during the production of sound, I should be able to transmit speech telegraphically."

He did, finally, and the world has profited.

Up in East Hartford, Conn., five years ago a husky chap with a close-cropped head of sandy red hair rubbed his chin meditatively too. If, he told himself, he could find out exactly how the vibrations ran through a propeller blade under stress, he could manufacture them much lighter and still keep them from breaking. If a prop tip lets go at high speed, of course, anything can happen. It can shear off a wing, go through the cabin like a knife through hot butter, or, by unbalancing the entire prop assembly, rip the motor from its nacelle.

All those things have happened.

Working for the husky, red-haired fellow, who was none less than Frank Caldwell, engineering manager of the Hamilton-Standard Propellers Division of the United Aircraft Corporation, was Erle Martin, his chief engineer.

Martin, by the way, got into the aviation business entirely by accident. An electrical engineer upon his graduation from Penn State, he was driving through Hagerstown, Md., one day in 1929 when he passed an airplane factory. He had to go in and look around.

In an hour he was an employee.

Well, there was Caldwell with his problem. It looked like a tough job. It proved to be just that.

Like a doctor probing around in a wound for a bullet by lamp light, the Hamilton people at first confined their work to reproducing vibration stresses in stationary props. That was all right, but it gave no clue to the magnitude of the stresses.

Next, they fastened a two-inch "finger" of thin metal to a propeller blade at its inboard end. The outboard end was fitted with a diamond tip. As the thin strip of metal flexed with the rotation of the propeller, the diamond tip made scratches on a metal plate beneath it. The length of the scratches were proportional to the stresses involved.

That gave the magnitude of the stresses, which was something anyway.

"But we still don't know," said Caldwell to Martin, "what the frequency or wave form of those vibrations are."

"Right," said Martin, "but we'll find out."

Russell Newhouse worked with Peter Sandretto to perfect the terrain indicator.

Sandretto, chief of United Air Lines' communications laboratory, points to the instrument he and Newhouse developed. The device's biggest fault is its excess weight.

They tried to do it with mirrors next. A series of tests was run with small concave mirrors fixed to the blade. They reflected a beam of light onto a ground-glass screen, tracing a wavy, circular pattern. The only trouble was that the patterns looked like a futuristic painting. They were hard to analyze.

Martin sat back and heaved a sigh.

The only solution would have to be some type of electrical device, coupled with an oscillograph, one of those things you can find in any radio repair shop. It has a little window where the picture of a current plays tag with Ohms. The farther the engineers went, the more syllables it took to describe their equipment. One was an electromagnetic accelerometer, and don't ask me to describe it.

The turning point came when the General Electric Company found that strips of paper, painted with a thin layer of carbon paint, were electrically sensitive to strain. On the final lap of the chase after a vibration tester, Hamilton carried on only 500 or so more experiments.

Today at the East Hartford factory engineers, their problem finally licked, glue a sliver of baked carbon composition to a prop blade. The engine turns the prop over. Vibration waves dance in the window of the oscillograph—or, more often, the vibrations write their own history on a drum for future study.

The secret lies in the fact that the bit of carbon can carry less current when it is bent than when it is straight. Minute wires are attached to it and run to the hub. There a collector collar picks up the variations in current and shoots them to the laboratory for analysis.

'Way back in 1930 a man by the name of Lloyd Espenschied, employed by the Western Electric Company, took out a patent on the idea of throwing a radio impulse at the ground, letting it describe a circle, and measuring the time it took for it to return.

It was a nice little problem. If an impulse were thrown from a plane a mile high, it would take only 1/94,000 of a second for it to be back knocking for admittance. The measuring couldn't be done with a caliper.

It was just an idea. The patent was filed and the pages on which it was described got dusty. Three years later the company rubbed its collective chin and began to wonder. Something might be done with that gadget. Something was done in an indifferent way, but companies must have money to run on and Western Electric could see no commercial application in the idea. Back to the files it went.

Two years ago Peter C. Sandretto, now chief of the United Air Lines communications laboratory, popped on to the scene.

"Look here," he said in effect to the Western Electric people, "you've got a collection of ideas here for bouncing radio impulses off the ground and seeing what happens. Why don't you do something with them?"

Sandretto, as you know, is generally credited with designing all the radio equipment for the DC-4. He is a little, unprepossessing fellow who gets so absorbed in studying his equipment that he could lose his pants in an updraft and never notice it.

Only 31 years old and a graduate of Purdue, Pete teamed himself with another engineer, his complete opposite in everything but enthusiasm. Russell Newhouse, of Western Electric, is the Adonis of aviation's research laboratories.

Together they began working on the problem of the absolute altimeter.

"Micro-wave, eh?" remarked Newhouse.

"Yep," nodded Pete.

With the unerring instinct of the born engineer, they cut through the preliminary and painstaking steps of using longer radio waves and gradually working toward shorter ones, in spite of the fact that a leading authority had announced only a short time before that the use of anything shorter than 35 megacycles was not practicable.

Frank Caldwell spent years trying to devise a way of charting propeller stress.

Caldwell's assistant who helped him solve his problem was able young Erle Martin.

Frequently working apart, meeting to exchange notes, Sandretto and Newhouse devised their little black wonder box. They had their off-days, their disappointments, but they found their solution in a micro-wave of 500 megacycles.

It worked. And don't ask me how.

The other day, flying high above the Hudson River, United's Boeing 247D laboratory ship passed over the George Washington Bridge. Streams of radio impulses shooting at the surface of the river completed their circuit to the plane to measure their own time on the round trip.

In the cabin of the ship were two dials, one connected to an ordinary pressure altimeter, the other to the little black box. Both registered 1,000 feet of altitude.

The ship crossed the bridge. The pressure altimeter never wavered. The needle on the other dial dropped to 800, bounced back to 1,000.

"It would be a long drop from the roadway of that bridge to the Hudson, wouldn't it?" grinned Sandretto.

And now to cut back to the fellow who sat in the cockpit of the ship on the Indianapolis airport.

Francis Moseley, one of the Sperry Gyroscope Company's project engineers, is one of those easy-going individuals who doesn't give a hoot and a holler whether he gets his name in the paper or not. In fact, he would prefer that he didn't. The principal thing in his life is to make something that works.

Sperry had produced the flight ray. High up in its massive building at the Brooklyn end of Old Manhattan Bridge which spans New York's East River, this combination of several instruments designed to make piloting easier had been shrouded from the public eye for months.

Even before the famous shielded loop for direction-finding had been announced and finally made mandatory for use on the airlines, Sperry had filed away in Washington's Patent Office an idea for turning a knob and making a needle point at a radio station.

"You know," explains Moseley with a grin, "just to keep some other guy from beating your time."

It is the same idea of slapping an engagement ring on a girl's finger.

But there the scheme remained. Occasionally it would be brought up in formal and informal conversation at the Sperry plant. The overlords of the establishment would ask what was "in the works." The answer was a lot of pressing business, and the little gadget with the needle could wait.

On that day at Indianapolis, Moseley, whose mind had lingered on the idea of an automatic D. F., saw an opportunity to build one. Necessity was the mother of his crude invention. An ordinary right-left type of direction finder, placed on the face of the flight ray for experiments in landing blind, was not sensitive enough.

Moseley, who had conferred with the RCA Manufacturing Company about the thing and had done some work with Donald Bond of that company, climbed out of the airplane. And he went to town,

Lloyd Espenschied first patented the principle of the radio "terrain indicator".

in more than one sense.

In addition to the windshield wiper motor, he purchased some ordinary telephone relays. He contrived a box and a dial. He fixed up a shielded loop and a sense antenna. The whole thing was ready, but would it work?

Moseley turned a knob to tune the set to the proper frequency. The needle swung around under the impetus of the motor and stopped. That was the direction the signals were coming from. It was a simple matter to insert a course scale on the perimeter of the dial. Synchronized with the magnetic heading of the airplane, the course scale and the needle in a brief space of 20 seconds can be used to obtain cross-bearings from which the exact position of the plane can be plotted.

There was other work left to be done, of course. Bond and Moseley had to contrive a way to keep the needle from "hunting." But that was their business, and they accomplished the job.

The radio direction finder—thanks to aviation's "gadgeteers"—is today one of the greatest advancements in modern aeronautical science. It is that instrument that has solved many of the airlines' most trying—and dangerous—problems. Only recently added to the equipment of domestic American airlines, the DF actually has been used by an American company (Pan American Airways) in its overwater operations for several years. Moseley's and Bond's automatic DF is that next step in the instrument's advancement. Domestic airlines already are considering purchase of the device, a practice for which all American companies should be commended.

A few days ago a fellow engineer remarked to Moseley, "Funny we didn't think about equipping the automatic D. F. with automatic tuning. I've got it on my home radio set."

"Yes," responded Moseley, "we should have thought of that. Just push a button, huh? Well, that'll come next."

END

Unusual City

UNKNOWN to residents of Baldwin, Kansas, was the fact their city is distinguished from the air at night by a perfect cross formed from the lights of the city's two principal intersecting streets. In a letter to the city's Chamber of Commerce, a Braniff Airways official stated that Braniff hostesses always pointed out Baldwin to passengers as "the city of the cross."

This information was most interesting to F. C. Leitnaker, editor of the Baldwin *Ledger*. "Baldwin," he said in a letter to the airline, "is generally referred to over Kansas as the center of Kansas Methodism and on occasion has been dubbed 'The Holy City.' Strangely enough, your airline crosses Baldwin at the intersection of the cross, one bar of which is historically known as a part of the old 'Santa Fe Trail,' while the other bar is known as a leg of the 'underground railroad' over which slaves were transferred through the free states as early as 1850. So, while the cross which can be seen from the airway is purely accidental, we feel it is an appropriate marker of this community."

Some War Dope

A MESSAGE from POPULAR AVIATION'S correspondent in Russia gives some clue as to why Russian-built aircraft are so feared in the current Spanish and Chinese wars. The Russians, we are informed, make no bones about producing Russian-built American warplanes, most of which are, in turn, sent to fight against Japan or in the Spanish fracas.

The Russians, for instance, recently purchased sample Seversky warplanes, one of which is known as a "flying arsenal." It carries, besides a crew of two, seven machine-guns and 600 lbs. of bombs. Then, the Soviets are in production on the single-engined Vultee bomber which they are building under American license. It also is reported that an American production license has been granted Russia by the Curtiss company for the construction of twin-engined warplanes similar to the present A-18 attack ship in use by the Army Air Corps. POPULAR AVIATION'S correspondent quotes a reliable source in saying that Russia now is seeking license to build the Boeing *Flying Fortress* type bomber.

A Tip

PILOTS accustomed to stick control who transfer their activities to wheel controls should not rest both hands on the wheel as though they were driving a car. They should keep one hand on the wheel and the other on the throttle especially when coming in for a landing. Otherwise they might get in a jam if they need power quickly.

At right is the nose of the new B-18A with its elevated position for bomber.

★

The original B-18 is shown below. Its nose is similar to that on the old B-10.

LIFTED FACE

The Army Air Corps, seeking a more efficient bomber, has designed new gun and bomb stations on the B-18A.

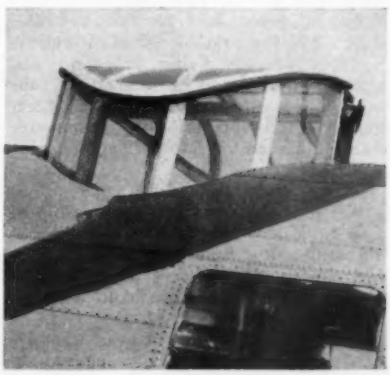
WHEN the Army Air Corps took up an option with the Douglas company for 78 additional B-18 bombers they had by that time learned enough about the airplane to have its face lifted to advantage. After discussing the ship with pilots who had flown it in simulated wartime conditions and maneuvers, Air Corps engineers took a somewhat revolutionary step and "redesigned" the bombardier *above* the nose turret machine gunner. This is perhaps the first time that particular arrangement has been used.

As this was being written, the optional order for 78 B-18A's (as the revamped model now is known) is well along on the Douglas company's production line. As a matter of fact, the manufacturer produced the first group in this batch so fast that the Army—badly in need of pilots—could not detail enough airmen to ferry the ships to their respective bases. As a result, a great many of the finished ships were lined up outside the Douglas factory for some time awaiting pilots.

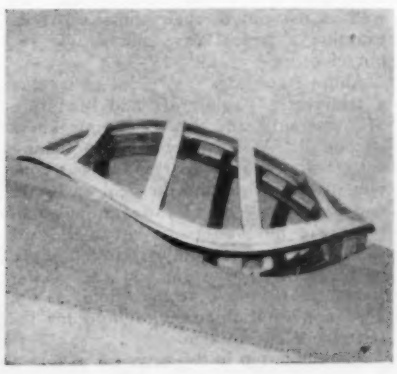
Basically, the B-18 and B-18A are considered by Air Corps officers to be quite successful in their appointed missions. Several squadrons of the B-18's have been in use for some time. In fact, the Air Corps squadron in Hawaii that recently an extensive flight out over the Pacific in formation for navigation and bombardment practice, made the flight with B-18's.

Despite the fact that the Air Corps bombardment officers are advocating giant long range bombers like the B-17 and XB-15, bombardment squadrons are nonetheless being outfitted with the lighter Douglases. These are replacing the time-honored Martin B-10's which have been the staple light bomber in the Air Corps for several years.

As stated before, the most unusual feature about the B-18A is its nose arrangement. It has been standard practice in bomber design to have the forward machine gunner in the uppermost position on the ship's fuselage. The bombardier always has been down in the ship's belly, usually right on the fuselage floor. But Douglas and Army engineers established some sort of precedent in redesigning the B-18. As can be seen in the accompanying photographs, the bombardier has the highest position in the ship's nose. The jutting compartment enables him to sight ahead of the gunner.



Above is the old B-18's retractable "chicken coop" in rear of fuselage.



The B-18A's rear gun turret also was redesigned for streamline efficiency.

Mr. Barringer, a power-plane—as well as glider—pilot, after a soaring hop.

Here's a sport any pilot can enjoy. The author, a noted pilot, heads the Soaring Society of America.

SOAR YOUR LIGHTPLANE

by LEWIN B. BARRINGER

EVERY day we hear of new recruits to the fast growing ranks of private owners of light airplanes. Thanks to the progress being made by the leading manufacturers of these craft, more and more people, both men and women, are experiencing the pleasures to be derived from flying. But are the great majority of these owners of aircraft getting the maximum pleasure as well as use out of their ships? Let us examine a typical case and decide for ourselves.

About two years ago a friend bought a trim little Taylorcraft and his pride of ownership and joy of flying knew no bounds. When he was not polishing and photographing his ship, he was content just to fly around the field on week-end afternoons. Soon, however, he began to spread out and make short trips of 30, 50 and a hundred miles. He found the problems of navigating and the satisfaction of hitting a strange field on the nose a new stimulation to hold his interest and enthusiasm.

The next step in this amateur airman's flying career was the joining of a live-wire aviation club. To his pleasure of cross-country flying was added the enjoyment of having other ships along on weekend cruises. Before so very long, however, he had been to every field within the range of his ship's performance and the spare time available for flying on his weekends.

An active director of his club seeing a falling off of interest among a number of members began to organize sport flying events such as handicap races, bomb dropping, spot landing and the like. These had the valuable effect of improving our friend's flying judgment and skill and keeping up his interest. As the months passed he also added an occasional business trip to his reasons for flying but then his interest definitely began to lag.

"Well", argued he, "if I could afford a 450 h.p. Beechcraft and was able to hop to Miami in five hours, I suppose I'd still get a real kick out of flying, but the fact is I can't and I've just about run out of things to do with the ship."

Just there is where he was wrong—making the same mistake so many other pilots make. As was my case some years back, he did not realize that, like Dr. Russell Conwell's famous "Acres of Diamonds", there is a wealth of new experience of the most thrilling as well as valuable sort right under his airplane's nose . . .

Like the rest of us, he had often flown on bumpy days when it was something of a job to keep the little ship level and he had to watch his step in approaching and landing. He had never bothered to find out what caused these bumps and what use he could make of some of them. Now here is what he can do to improve his piloting technique, his knowledge of meteorology and his joy of flying in a vast field that offers countless opportunities all the time.

The first step is to learn something of the theory of soaring flight by reading such books as "Kronfeld on Gliding and Soaring", the English translation of Wolf Hirth's book on soaring technique and the Gliding and Soaring Operations Manual soon to be made available by the Soaring Society of America. From these he will get a clear understanding of the theory of motorless flight and its tremendous possibilities. He will learn all about gliding ratios and sinking speeds and how they effect a ship's performance.

In comparing the motor-off performance of his ship with a training glider he is apt to get something of a shock. A general purpose utility glider has a sinking speed of three to four feet per second and a gliding ratio of fifteen to one. This means that the ship loses about four feet of altitude every second in still air and will glide 15 feet forward for every foot it comes down. This seems like pretty poor performance when compared to a high performance sailplane like the new American Ross which has a sinking speed of only two feet per second and a gliding ratio of 27 to one. So it is, but it seems good compared to the average lightplane which will sink at better than six feet per second and glide at not more than ten to one. "Then how," he will argue, "can I hope to do soaring with my ship?"

Nature gives the answer by often supplying updrafts of sufficient strength not only to keep a lightplane aloft but also to enable it to climb with its engine completely throttled. Recently I was up in the White Mountains of New Hampshire visiting friends. To get a better view of the marvelous colors of the autumn foliage on the mountains, I drove over to the airport at North Conway and rented a red, 35 h.p. Aeronca. Cruising along the windward side of Redstone Mountain overlooking the airport, I pulled the throttle all the way back and continued to maintain altitude while making figure eight turns. On another day, flying in a northeast wind, I cut the engine off at 2,700 ft. opposite North Moat Mountain. By careful slope soaring, I climbed right up until I was looking down from two hundred feet over the top of the 3,100 ft. peak.

This was purely for pleasure but on another flight with a 40 h.p. Aeronca and a friend as passenger we flew over the 6,276 ft. summit of Mt. Washington, having climbed to that altitude in less than 20 minutes by judicious use of slope winds found en route. This represented a real saving of time and gasoline.

All this was purely slope soaring on winds mechanically deflected upwards. Far more important and potential is thermal soaring on invisible bubbles and columns of air rising because of the unequal heating of the earth's surface. To do this effectively it is necessary to equip your ship with a variometer or sensitive rate of climb indicator. Generally your own bodily sensations are of little or no value to tell you whether you are rising or falling. An ordinary rate of climb is somewhat sluggish and an altimeter is far too slow. What is needed is a sailplane instrument such as those made by Kollsman, Askania, Horn and Cobb-Slater. The first three have a standard instrument appearance but the latter is very different as it has two small vertical glass tubes with a red ball in one and a green ball in the other. When the red ball pops up you are losing altitude—when the green ball moves up you are climbing.

Parker Leonard, well known sailplane enthusiast of Osterville, Massachusetts, recently took the Cobb-Slater variometer off his Wolf sailplane and installed it with its vacuum bottle on a *Cub* for the afternoon. He first determined the ship's engine-off sink at seven feet per second in still air. Then he flew under a big cumulus cloud, throttled back, and climbed rapidly upward. This thermal was rising at a rate of better than 10 feet per second so, of course, the ship was carried aloft as Parker kept it in a steady, steep spiral to stay within it.

Thermal upcurrents are sometimes much stronger than this. About five years ago I encountered one near Princeton, N. J., that I will never forget. I was flying a Waco "F" at the time and had just circled a small thunderstorm. Out of the rain with clear skies ahead but still under part of the cumulus, I suddenly saw the altimeter needle climb rapidly from two to four thousand. Throttling back and putting the nose down until the airspeed read 120; I found myself still going up.

This was like the tale told me by Johnny Miller, the autogiro test pilot. Out in the middle west he saw a great line storm preceding a cold front and flew out to meet it with his 'giro. Arriving in front of the storm at 2,500 ft., he cut his Pratt & Whitney *Wasp* and put the 'giro into vertical descent. In no time at all he was lifted to over 8,000 feet. A couple of fellows tried it in an Aeronca and were boosted to 12,000 and had a very hard time getting down before dark. Such flying near storms is dangerous for the novice but there is plenty of thermal soaring to be done by the lightplane owner on the average summer day that not only is not at all dangerous, but will result in an improved knowledge and piloting technique which will make him a safer pilot. Such was the flying done by Wildey Kimball and Roy Allen near Tacoma, Washington, in their Aeronca "K." They reported that in a 58 minute flight they used their engine only 18 minutes. The rest of the time it was idling at less than 800 r.p.m. At one time they gained 1,500 feet in two minutes!

On this day, a typical summer day with "unstable" air and good convection, there was a ground wind of about 20 miles per hour and cumulus clouds at 4,000 rising to over 7,000 feet. Wildey and Roy did their soaring between 1,500 and 4,000. Being wise, they kept out of the clouds because they had no blind flying instruments.

After landing they found that one of their students, Joe Perkins, was somewhat skeptical of their pipe dream-like tale so Wildey took him up. To make what followed even more impressive, I have only to mention the fact that one of the pilots weighs 225 pounds, the

(*Continued on page* 79)

Are the majority of lightplane owners getting the maximum enjoyment out of their ships? The author doesn't think so.

AIRPLANES BY

Above is a picture of the mass-production efficiency being used by the North American company.

This is the North American factory from the air. It was started in 1936.

by FRANK CUNNINGHAM

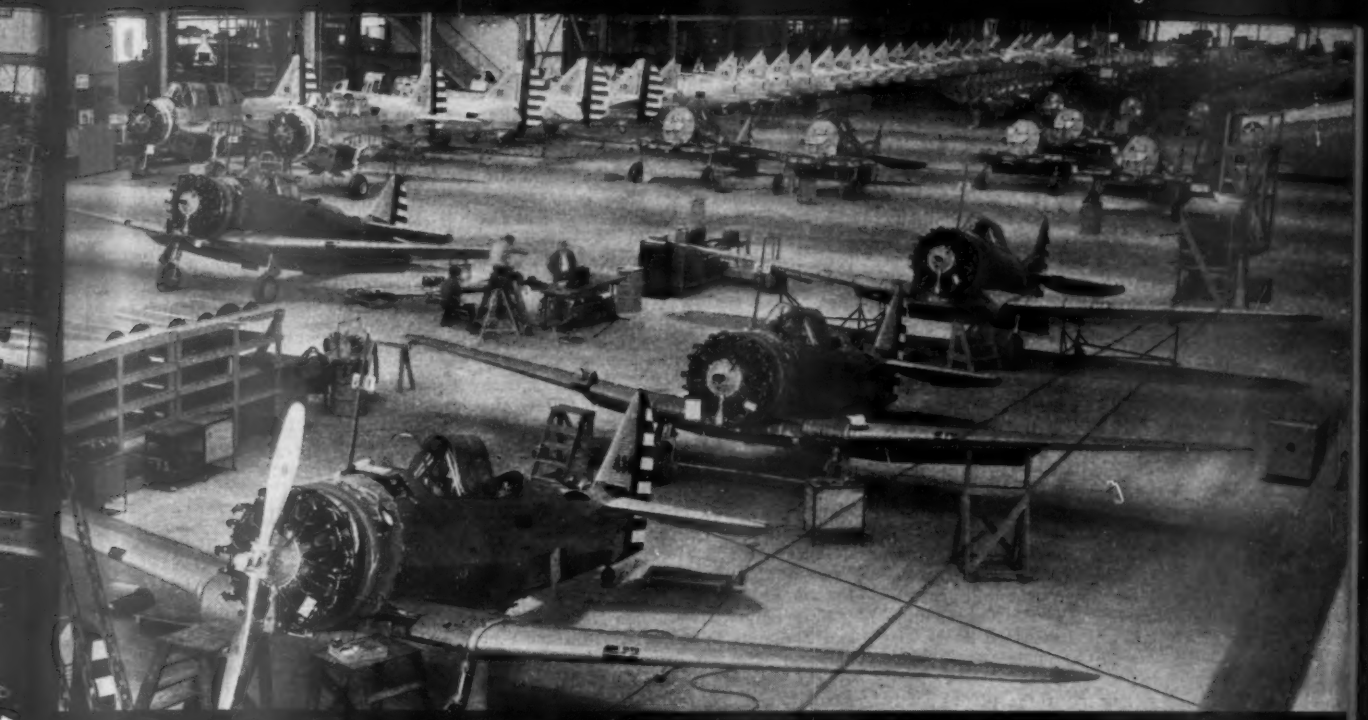
When the conversation turns to the possibilities of mass production in the aircraft industry, we refer you to a company that didn't exist a mere two years ago.

SHIMMERING wings silhouetted against a deep blue, cloud-flecked sky are a fitting symbol of the rise of the aviation industry from comparative poverty—poverty both as to public support and lack of financial backing. Great plants of today have often times come about because many years ago—as aviation history is reckoned—some dreaming genius in a hall bedroom put wings on a shoestring and made it fly!

This fact is what makes the North American Aviation company a standout in the field. North American is not an old company. It was unheard of as a builder when other plants were assembling famous ships that were to soar men into the air to fly to fame for themselves and for the companies. North American had no shoestring start with a small bankroll entrusted to a single ship's performance. Instead it was adequately and capably financed.

Born comparatively with a silver spoon in its mouth, N.A.A. has changed the spoon into a magic wand which recently produced airplanes in a record unequalled since the glue pot and sewing machine days of the World War. It may be said that North American employs the advanced production methods of the automobile manufacturers fused with the spirit of new achievement that is aviation's tryst with the ever encroaching future.

January, 1936, saw the brown dusty acres of ground adjoining the mission-like buildings of the Los Angeles Airport near Inglewood, California, topped by a



THE DOZEN . . .

Off the final assembly line (foreground) comes North American's average of three ships a day.

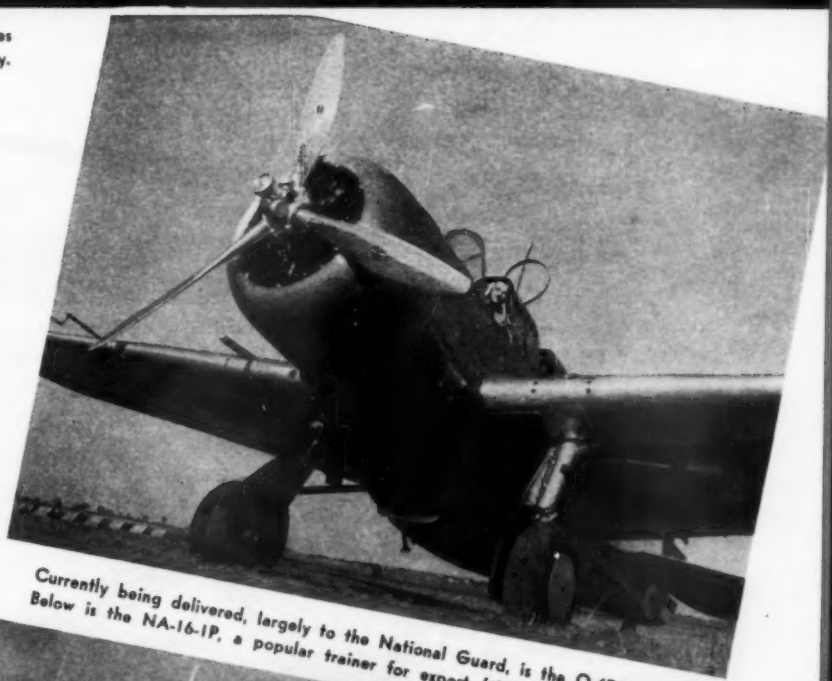
white, many-windowed factory. Some 400 workmen entered this building of 172,000 square feet, entered through a gate marked NORTH AMERICAN AVIATION.

Such was the recent birth of what is now one of the finest plants of the air world. True, it had ancestors. Back in the east, the Fokker Aircraft Company and the Berliner-Joyce Aircraft Company had been merged into General Aviation at Baltimore, Maryland. North American Aviation Corporation at that time was an investment holding company and it was not until 1936, after the removal of the main works from Baltimore, that N.A.A. began to function as a major production company.

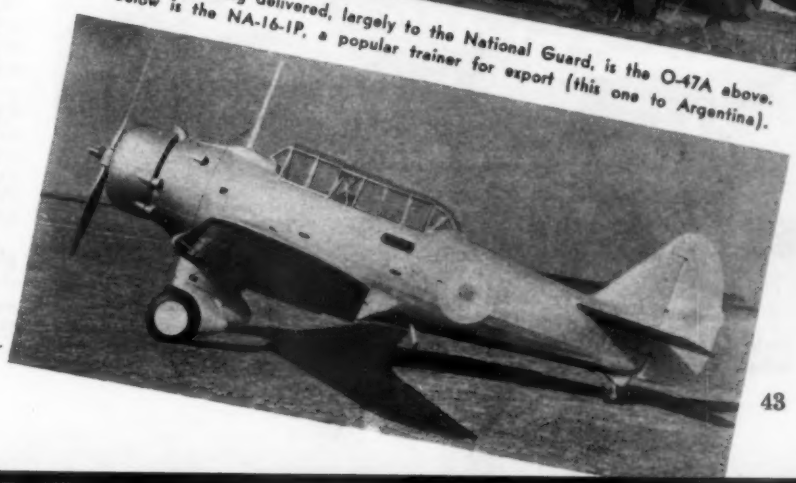
Only as far back as March, 1938, the company was still interested in airline operations and these activities were discontinued with the purchase of Eastern Air Lines by Captain Eddie Rickenbacker. The adequately backed organization could devote its energies solely to building airplanes in a manner that made one think of Detroit and motor cars rolling along an assembly line.

Ships of the sky had always been thought of as a hand-tooled product; as something on which infinite care must be taken; as a product that was the result of days, of weeks, of months, of sometimes years of continual labor.

But N.A.A. officials in their modern offices behind the cream and wood trimmed walls of the bright corridors thought otherwise. They contended that automobile production had been speeded and aviation production would be has-



Currently being delivered, largely to the National Guard, is the O-47A above. Below is the NA-16-1P, a popular trainer for export (this one to Argentina).



tened. Infinite care? Yes, but care by production men with a large investment in efficiency tools. Care by engineers working in an ultra modern plant, a plant complete with laboratories that were the test tubes of the skyways.

Thus it was in 1936 the company turned out among other planes nearly 100 BT-9 basic trainers for the United States Army, an order so well fulfilled that the following year brought a request for nearly 150 more. Production has been accelerated at such a pace that, at the present time, some 600 planes in service here and abroad can hum in song with their motors about a birthplace, the mansion-factory of North American. Before long 400 planes will be following their brothers' footsteps in the clouds.

August and September, 1938, found the peacetime production record cracked when each month saw more than 60 planes built. In August, 60 BC-1 and O-47A ships delivered to the Army Air Corps won the praise of a military official who stated "this is the largest number of airplanes ever released by an aircraft company in a single month since wartime."

Turning out nearly three planes a day —three ships that started early in the morning as a collection of assorted nuts, bolts, parts, aluminum, and fabric and by dinnertime end up shining with the blue and yellow colors of the Army and ready for flight—is a task the success of which can be traced to the steady expansion of the plant and the mass production scheme.

The original 172,000 square feet a year and a half after the ribbon had been cut, or the champagne smashed, or whatever it is that's done at a new building, had expanded faster than Alice as she came back from Wonderland. New additions brought the factory to 360,000 square feet. Even that was not enough. Efficiency production of airplanes brought new orders and new orders meant more space until October of 1938 finds the plant occupying some 450,000 square feet! The original less-than-500 workmen have increased more than sevenfold, or to approximately 3,500!

Even a mystic sometimes can't foresee the rush of business. With a backlog of about $9,700,000 in April of this year, the October order file of unfilled business has topped $16,000,000. Did someone say that business was going up in the air?

Returning to 1936 when North American made its debut in the top crust of aviation with an introduction that had all the swank of a Long Island garden party, one must realize that the million or three dollar baby of the industry, as far as production and fame was concerned, had to share the financial backing with the knowledge that there was a "spot" and the North American Aviation was in it. The question was could N.A.A. successfully compete with its rivals. Outside of the planes built back in Maryland, the buyers of military craft had no basis on which to judge the company.

Maybe there is a hero in the story of North American Aviation; some square-jawed individual who rushes about like Dick Tracy; who has the courage of Tailspin Tommy, and the winning personality of Mac in "Tillie the Toiler." If there is, no bugles are blown for him. Personalities are ruthlessly submerged in the company headed by J. H. Kindelberger, a former Douglas official, whose chief aide is J. L. Atwood, once head designer for the Douglas plant. North American is an example of man dominated by organization. However, it is a domination that brings out all that is best in the machine.

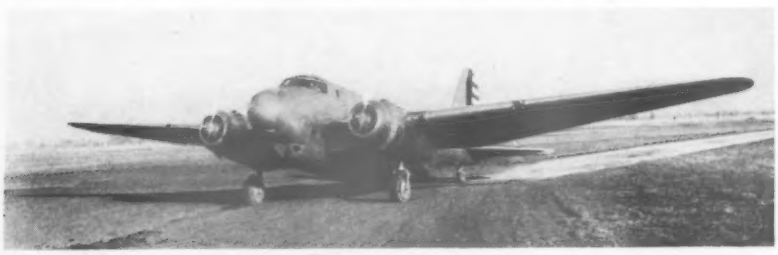
So it comes to pass that the hero of N.A.A. must be as mechanical as the robots in "R.U.R." The hero? The production line that spells speed and efficiency. It is the design of the airplanes and the production line that turns out the machines with interchangeability of parts, with planes whose shells can be quickly removed when repairs caused by enemy bullets are necessary, with planes alive to the needs of war tomorrow.

Inspection of the huge plant reveals straightforward working. There are no tangents, no missteps. From the 200 men in the drafting room on the second floor of the factory, to the new planes ready for delivery there is no waste motion. Under the saw toothed skylights a double assembly production line works and the raw material at the starting end takes on new additions every few minutes as the plane is built in a manner that reminds one of a strip tease dancer in reverse.

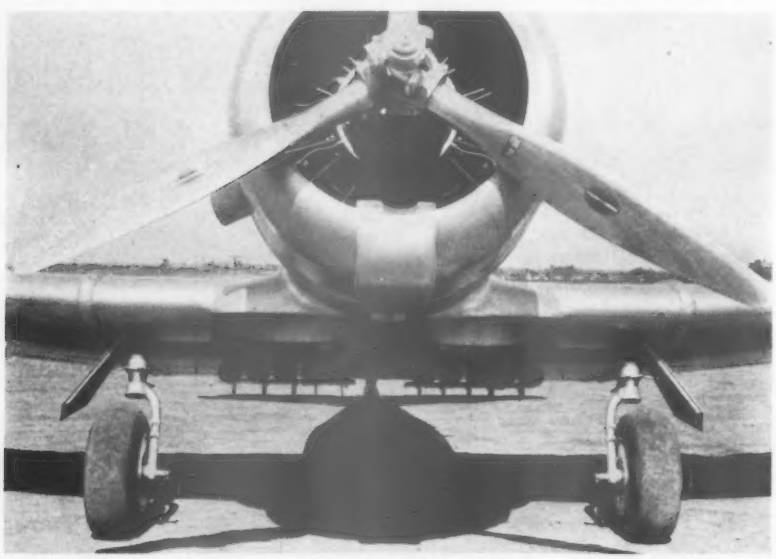
One walks down the center floor production line for the BC-1s, feels that he has seen the construction age of an airplane speeded up as though something were queer with Time. Along the line one sees the center section being tied to the fuselage. Eight bolts are screwed tight—and it's done! A few more steps and one watches while the ribs are soon covered with the blue of the panelling. Soon the motor is ready to be attached by four bolts. All connections are broken at the fire-wall so that exchange motors can easily be installed.

At the end of the production line, one looks out across the airport field to the mountains that hover over distant Santa Monica. Far to the left the gargantuan DC-4, pride of the Douglas company, rests before the Los Angeles airport hangar like a fat man vainly trying to get in his slim brother's formal dress. Close by the production line's end, but out in the sunlight that tones their blue sides with a gloss, eight new basic combat planes await claiming visits from their new masters, Air Corps officers soon to call for them.

To the right are the all-metal O-47A planes, the first ship designed for the Army to carry a third man who acts only as an observer. These planes are being delivered to the National Guard, the Air Corps, and the Army Reserves. Built here, the original plans were drawn up



Above is the experimental bomber North American entered in an Air Corps bid competition. It was called the "Dragon". The ship was rejected in favor of the Douglas.



North American's fondest hope is for a juicy share of the rising export market for military aircraft. This is the NA-16 (for export) with bombs and racks installed.

in Dundalk, Maryland, where N.A.A. has a branch plant.

As one starts to turn away from the field an orange and yellow plane races over the baked earth in a ground test. This is the NA-49, a ship built for the British government and there are 199 to follow. Planes over London, over Calcutta, over Manchester, over Perth! Ships born of the silver spoon will sail where flies the Union Jack of Britain!

And, too, planes now under the battle insignia of the Argentine Republic, Honduras, Venezuela and Sweden once were tested by North American on this same field. This company makes or is planning over a dozen different types of military planes. The latest announced is the NA-50, a single seat enclosed cockpit fighter. This ship will be finished about the first of November. With a constant speed, three blade propeller, the NA-50 is powered by a Wright *Cyclone* G3, has a top speed of 270 m.p.h. and a cruising speed of 231 m.p.h. This top speed makes it the fastest ship turned out by N.A.A. Service ceiling will be high—around 30,000 feet.

Newest design in ships already turned out by North American is the NA-44, a light attack dive bomber recently sent into production. This dangerous-to-foes plane has a Wright F52 engine of 875 h.p. The plane will zoom along at a high speed of 250 m.p.h. at a 7,500 foot altitude and has the advantage of a low landing speed of 60 m.p.h. Service ceiling is 25,000 feet and cruising speed 225 m.p.h.

The NA-44 is an answer to the military requirement for a light attack dive bomber that has both economy and performance. It is a two place, all metal, single engined monoplane that can do pursuit plane, as well as bombing and attack maneuvers.

This fast silver streak has a normal cruising range of over 1,000 miles and is built for four machine guns firing forward and one rear mounted gun. These guns are mounted (with the exception of the rear one) so as to be controlled from the front cockpit master switch. The guns may be fired together or one at a time. With the plane more than adequately provided with guns, bomb racks carry a message of lethal intent to opponents. These racks hold six 30-pound, or ten 24-pound, or four 100-pound bombs.

Perhaps the unique item about the NA-44 is that it doesn't have gas tanks. All fuel tanks and equipment necessary to go with them is eliminated. And as a result a greater fuel supply can be carried. The plane holds 170 gallons of gas in a fuel tight bulkhead which runs from front to rear spar and the length of the entire center section. This gas assembly is claimed to be more economical to build than the customary fuel units in tanks and at the same time is stronger and freer from leakage than more usual types.

Doors on the bottom of the gas compartment are as numerous as those in a Fun House in an Amusement Park. Inspection and repair work is relatively easy to do by means of 12 hand doors. As is the case with all North American ships the panels of aluminum alloy construction are removable for repairs to the interior or to the shell itself.

First N.A.A. ships to win renown were the trainers brought out in 1936 and these were followed by the basic combat planes which are said to contain "all essentials of a tactical ship without the difficulty of handling that some of the tactical ships have."

Aviation students find the step from training ships to tactical planes made more feasible and without much of the usual danger to life, limb and telephone poles. N.A.A. has designed its BT-9 trainers to make them as simple in operation and maintenance as practical. These ships are widely used by the Army Air Corps and the Air Corps Reserves and are used by advanced training groups in South America, Belgium, Holland, Sweden, Australia and China. The Chinese are doubtless using them as fighting planes. The company also has a Navy trainer called the NJ-1. Outside of the primary trainer built for export which has a high speed of 125 m.p.h., the trainers are the slowest ships with their 400 h.p. engines sending the planes at a high speed of 170 m.p.h. and a cruising speed of 155 m.p.h. The primary trainer has a ceiling of 13,000 feet as compared to the service ceiling of 18,000 feet on the basic trainer. It will be recalled that the NA-50 has a service ceiling of 30,000 feet. Incidentally, one of the features of the BT-9 that gives younger flyers courage is that because of the forward position of the wheels it is practically impossible to nose over the ship in landing. This is extremely valuable, especially for primary student work.

The basic combat plane which the Army started ordering in large quantities late in 1937 is an outgrowth of the BT-9 with a more powerful engine, greater strength, and a retractable landing gear. The BC-1 uses a Pratt & Whitney "H" Series *Wasp* and the flaps are hydraulic instead of mechanically operated as in the trainers. It has a high speed at sea level of 180 m.p.h. and a service ceiling of 21,300 feet.

Although North American has cracked the production record, the company is certain that should it ever be called upon to do so it could more than triple this production. Should demands for warplanes for the government in critical times ask North American to turn out 200 planes a month, the company could do it!

The first year of operation in California for N.A.A. found the company with about $1,000,000 worth of orders on the ledger, the second year saw this increased to between $9,000,000 and $10,000,000. And now the third year draws toward its close with a backlog of over $16,000,000!

From plans on the architect's paper shortly before 1936, N.A.A. has developed to a factory from which have come fighting planes that patrol in far off lands the world over.

Which all goes to show that there's no harm done if one is born with a "silver spoon"—(even if it is only silver plated) *if* there are the brains to use it!

END

North American also built the currently popular Army Air Corps trainer, the BC-1. This model is used largely for advanced training and fighting maneuver training.

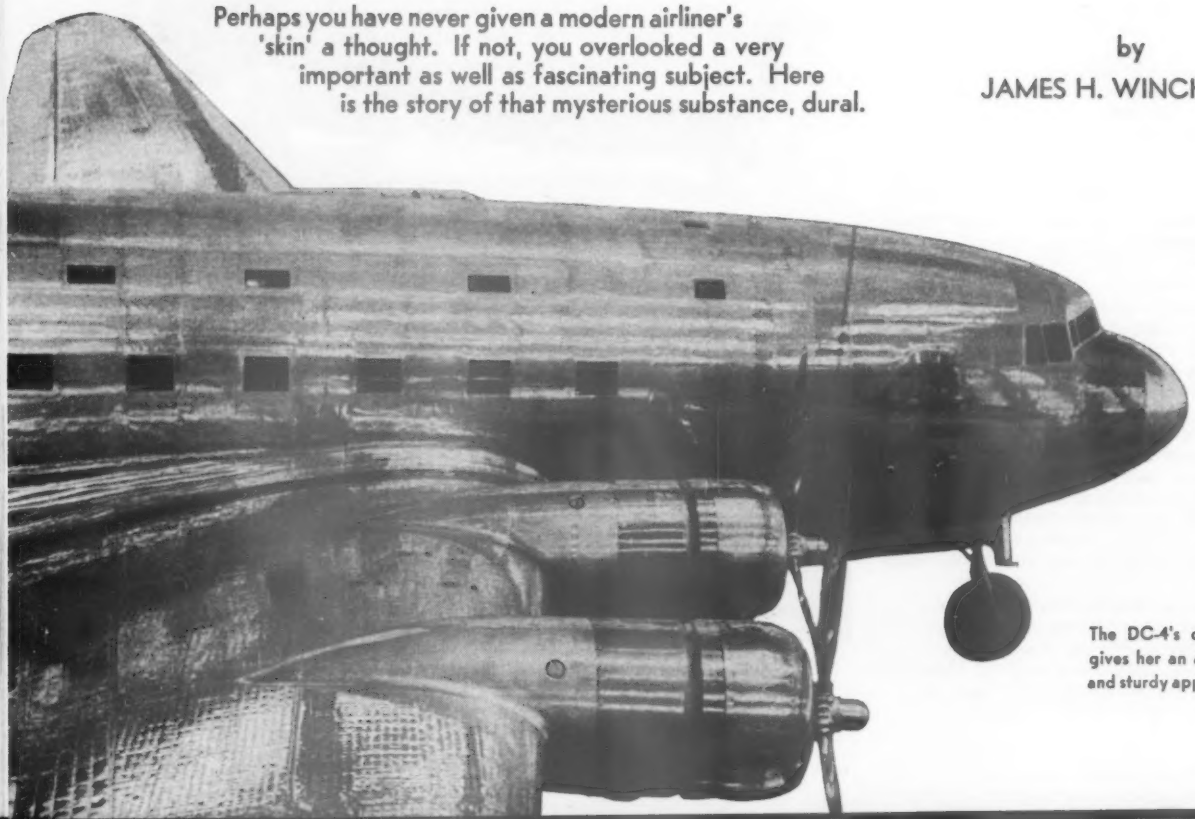
The NA-44 is a more powerful model offered for export trade. That company's export appetite has been temporarily satisfied by a 200-ship order from Great Britain.

'TIN'-SKINNED AIRPLANES

Above is one of the giant rolling mills at Alcoa.

Perhaps you have never given a modern airliner's 'skin' a thought. If not, you overlooked a very important as well as fascinating subject. Here is the story of that mysterious substance, dural.

by JAMES H. WINCHESTER



The DC-4's dural skin gives her an attractive and sturdy appearance.

YOU stand at an airport fence and watch a huge twin-engined all-metal airliner take-off into the afternoon sky. For a long time you watch the sun bounce its rays off the silver sides of the man-made bird as it soars into the distance.

Perhaps you think of many things as you watch that silver plane soar away. Perhaps you are thinking of the Wright brothers at Kitty Hawk and their frail little craft of wood and canvas; maybe it is the thought of the Lone Eagle in a single-engined plane winging his way eastward across the Atlantic on a bleak day in 1927. Or you might be looking into the future and seeing a plane, with more than a hundred passengers resting within its cabin, winging its scheduled way across the ocean to a distant land.

But it is doubtful if you think, or ever have thought about the metal—aluminum—that, to a large degree, makes the marvel of modern commercial air transportation possible.

One day, recently, our thoughts strayed to what was behind the glorified ballyhoo of a modern transport plane. Thoughts leading to action, our path led us southward to the modern airport of Knoxville, Tennessee, where, on the outskirts, long brick buildings stretch away into the distance of the Tennessee hills. Therein, unpublicized, unheralded, is the womb of commercial aviation in the United States today.

There, at Alcoa, Tennessee, near sources of cheap electricity made possible by the Little Tennessee River System, the Aluminum Company of America (and all modern transport planes in commercial use in the world today are made of an aluminum alloy manufactured principally by this company) has an important plant for the production of metallic aluminum. Here, also, is located a large fabricating plant, within the shadow of transport planes gliding to landings at Knoxville airport, for the manufacture of aluminum-alloy sheet used in airplane manufacture.

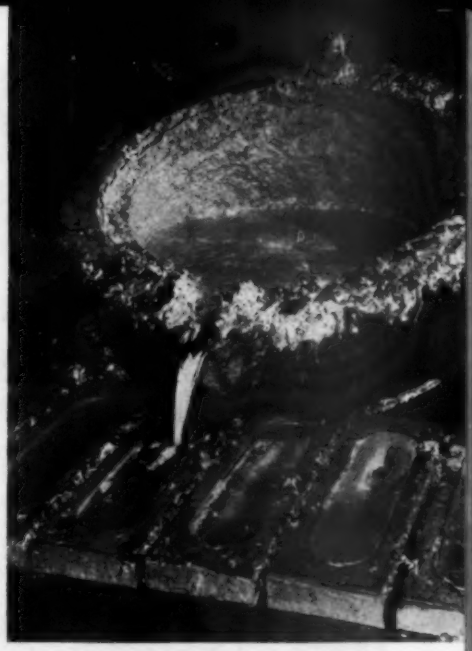
First step in aluminum production is the mining of bauxite, a hydrated aluminum oxide containing a few impurities. That used in the United States (and therefore used in the major production of airplane aluminum alloy and Alclad) is mined either in Arkansas or South America, from where it is transported to East St. Louis, Ill., or Mobile, Ala., for purification. A chemical process is used to remove the impurities from the bauxite to leave aluminum oxide, a pure white powder known as alumina.

The alumina is shipped to Alcoa and other reduction plants where it is reduced to metallic aluminum by means of the revolutionary process which Charles Martin Hall developed scarcely more than 50 years ago. Large quantities of carbon electrodes and much electrical energy are required by this process. Over .6 pounds of carbon electrodes and 12 kilowatt-hours of electrical energy are needed to make just one pound of pure aluminum. This amount of electricity according to statisticians, would keep a 40-watt bulb burning for twelve and a half days in a continuous stretch.

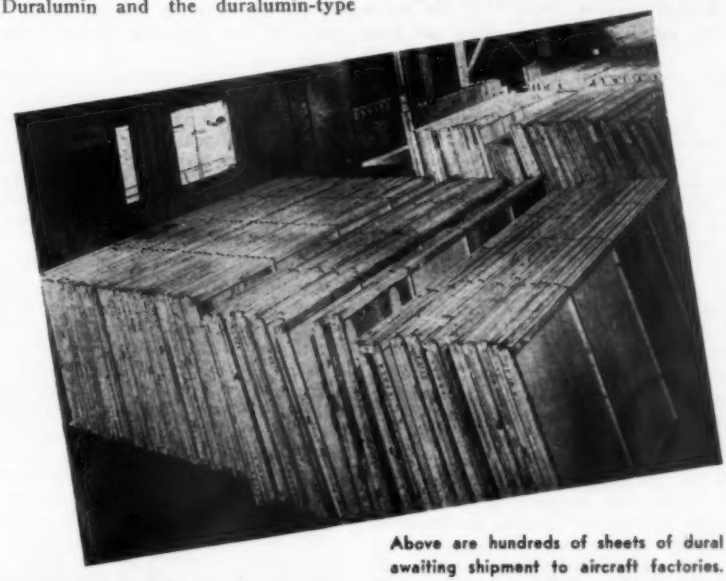
In one day the aluminum industry of the United States uses enough electricity in the manufacture of aluminum to supply a city of 17,000 homes with current for a whole year. Of course, it is to be understood that all of this aluminum is not directed to the manufacturing of parts for the aviation industry, although a great portion of it is made into an aluminum alloy that eventually finds its way into some vital part of a modern sky liner.

Aluminum alloy, such as that manufactured at Alcoa, fulfills a long-felt place in the requirement needs of aircraft manufacturers. It is a material which possesses high strength, light weight, ease of forming and durability. Aluminum weighs but one third as much as other common metals and, in pure form, is easily worked and has a high inherent resistance to corrosion. By proper alloying, fabrication and heat treatment, it is made as strong as structural steel, yet retains its light weight. The alloy also possesses, in large measure, the other desirable qualities of pure aluminum.

Duralumin and the duralumin-type



This is pure aluminum pouring into molds.



Above are hundreds of sheets of dural awaiting shipment to aircraft factories.

This is the sheet and plate mill from which Alclad goes to the nation's builders.

Aircraft covering comes from this, the largest non-ferrous rolling mill in the U. S. This mill is capable of rolling out Alcoa plates 75 feet long and 12 feet wide.

alloys are the ones which best meet the needs of the aircraft industry. Duralumin, a heat treated aluminum-copper-magnesium alloy, was developed by Wilm of Germany in about 1907 and was largely responsible for the change to all-metal construction of airplanes. This dural is used as the core and basic foundation for the outer covering of the plane. The spars and ribs of the plane are constructed out of specially molded duralumin. Over the dural is fitted a paper thin coating of almost pure aluminum known as Alclad which has a special durability in withstanding weather and various types of cleansing fluids used in washing the airplanes. It is this outer coating of Alclad you see on the airplanes today.

While the type of duralumin developed by Wilm was responsible principally for the change to all-metal construction of airplanes, it has lately been superseded by an aluminum-copper-magnesium-manganese alloy, 24ST, which has a 25 per cent higher yield strength. The latter alloy, it is claimed by aircraft engineers, has a typical ultimate strength as high as 68,000 pounds per square inch.

All right, now, let's follow a load of bauxite, from the time it arrives at the reduction plant at Alcoa until the time it is transformed into a silver plate of shining aluminum, packed and ready for shipment across the country to the airplane factories of the west coast where trained men mold it with skillful hands into a shining bird that answers the command of man to fly.

But first let's know something about why this particular site on the end of the Knoxville airport, far from the mines where bauxite is taken from the ground, was chosen as a place to produce this valuable metal.

The answer is—power. To make aluminum requires, as we have shown you before, enormous quantities of electrical power and at Alcoa the officials of the Aluminum Company of America (from the initials of which the town draws its name) have an abundance of water power available from developments on the Little Tennessee River and from the government controlled TVA project on the Clinch River.

Simultaneously with the study and development of hydroelectric power plans on the Little Tennessee River System, the company built a reduction works for the manufacture of aluminum at the present site of Alcoa. That plant was completed and placed in operation in 1914. Five years later a carbon plant was built to supply the necessary electrodes for the reduction works. In 1920, the first unit of the fabricating plants—a rolling mill for the manufacture of aluminum sheet—was placed in operation while, in 1929, the company completed an aluminum bronze powder plant. In 1931 the second unit of the fabricating plant was increased by building a rolling mill for the production of aluminum plate.

Today the Alcoa plant makes approximately 30 per cent of all the virgin aluminum produced in the United States and here, also, is located the largest aluminum rolling mills in the country.

First in importance at Alcoa is the works in which commercially pure aluminum is made. Here, in long rows of electrolytic cells, the aluminum oxide, a white powdery substance from bauxite, is separated into its component parts of aluminum and oxygen in a bath of molten cryolite by means of electricity. The oxygen unites with the carbon anodes to form carbon dioxide, while the aluminum drops to the bottom of the cell to be tapped from it as the white silvery metal which has become so useful in the

(*Continued on page* 83)

Recognize This?

THE layman, listening to an aircraft broadcast or station-to-airplane conversation, is often confused at the cryptic messages that he hears, especially those sent out from the ground station giving weather information just before the landing of a plane. Perhaps the following explanation will help to make these reports more intelligible.

After the contact is established between ground and ship, the ship's operator says, for example, "Go ahead, Chicago." The ground station operator may respond, "3500. High overcast. Southwest 12. Kollsman 29.82." This message is then repeated by the operator in the plane, to check for errors. The above message means

3500: the ceiling, or lowest cloud level, is at 3500 feet.

High overcast: this cloud formation is fairly solid. ("Light scattered" would mean clouds light and scattered.)

South-southwest 12: the wind at the airport is from the south-southwest and has a velocity at the ground of 12 miles per hour.

Kollsman 29.82; the standard atmosphere sea level pressure, or "Kollsman number," is 29.82 inches of mercury. The pilot sets the barometric scale of his Kollsman altimeter to this number and knows that the instrument will read the altitude of the field when landing. "Kollsman" is the airman's way of saying "altimeter."

Fledgling Facts

STUDENTS who solo faster than the average fledgling are not necessarily the best pilots. Instructors of the Boeing School of Aeronautics in Oakland, Cal., pointed this fact out recently. After careful study, the Boeing school's veteran airmen agreed that the student's speed at graduating from dual instruction gives little indication of that student's ability.

According to the Boeing instructors, it has been noted that a psychological reaction appears in most students in about the eighth hours of dual instruction. Students tend to worry considerably if they have not been soloed by their tenth hour. Often, however, those who absorb flight training slowly at first can be expected to make rapid strides thereafter. And there have been many instances where the exact opposite has occurred.

So Soon?

SOMEWHAT of a record was reported recently by POPULAR AVIATION'S European correspondent. The Turkish Air Force has just retired five Italian-built Savoia-Marchetti naval reconnaisance airplanes that have been used steadily by the Turks for 15 years! Turkish aviation officials finally decided the ships are worn out.

The MAN UNDER THE HOOD

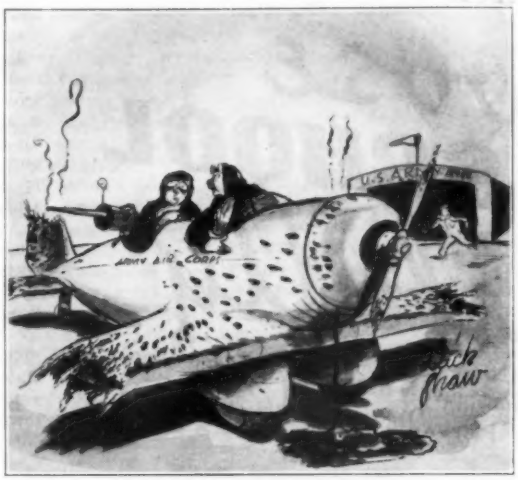
NOT long ago the **U. S. Navy** bought two **Stearman-Hammond** "safety planes" . . . the **Stearman-Hammond** is the ship that caused such a furor in the aviation industry when **Eugene Vidal,** then head of the Bureau of Air Commerce, said it could be marketed for $700 . . . actually, the ship ended up selling for $7,100 . . . the **Navy** paid a figure not far from that for each of the tricycle-geared ships . . . but when we asked the **Navy** just why they spent roughly $15,000 of Johnny Public's money that way, they told us to mind our own business . . . the other day we discovered that Naval gunners are taking anti-aircraft pot shots at the **Stearman-Hammonds** which, a Naval officer tells us, have been rigged up as radio-controlled targets . . . we have it from good authority that one of those gunners scored a direct hit on some of our hard-earned taxes just recently . . . incidentally, the **Navy** has banned official photographs of its **Stearman-Hammonds** and refuses to give a sensible reason . . . but POPULAR AVIATION has had pictures of the ships in its files for more than a year . . . you'll find one of them in the Letters department of this issue . . .

* * *

Aviation men were somewhat shocked not long ago at a newsreel of the **Chinese-Japanese** row . . . one scene showed a standard American-built transport flying over a Chinese city on a bombing raid . . . suddenly the film showed the belly of the American ship open up and drop a salvo of bombs . . . the Japs bought several of these ships some time ago . . . but they ordered them complete with passenger seats and other accommodations . . . they ostensibly were intended for use on the Japanese airlines . . . inasmuch as the American manufacturer concerned is vehemently against the use of his ships for war, the Japs obviously "pulled a fast one" . . .

* * *

These four-engined airliners coming up—those that have been ballyhooed to the skies by short-sighted airline officials—have turned out to be a downright pain-in-the-neck, financially speaking . . . the airplanes themselves are meeting expectations in admirable fashion . . . but, sometime ago, we asked certain airline officials how in the world they ever hoped to fill giant 40-passenger ships when they were having a devil of a time filling their present-day equipment . . . in effect, we were told that the reason those officials held their jobs was because of their "far-sighted ability" to make sensible investments and decisions . . . and, it was added, we were to go back to "dishing dirt" and mind our own business . . . well, that was months ago . . . today at least two of those giant airplanes are on the verge of delivery . . . and those airline officials are up against a wall . . . we have highest authority that one major company has cancelled its contract with a manufacturer (for which said airline will be sued) . . . the other lines are trying to figure out where they will get the money to pay for the ships they've ordered . . . all of this, of course, aside from the fact that they stand an excellent chance of "losing their shirts" with the empty giants . . .



"Well I must say, Johnson—you've certainly failed, and failed miserably!"

* * *

Remember the **Navy's** four-engined **Sikorsky** XPBS-1 patrol bomber? . . . reason it's been so hush-hush is that it's been on a year's service test in the hands of Naval pilots . . . but it was back in the **Sikorsky** factory not long ago for minor changes and overhaul . . . reports are that this huge ship carries eight 1,000 pound bombs and has a cruising range of 4,500 miles . . . we also hear that **Sikorsky** already is hard at work designing the **Navy** another big boat that's said to be 2½ times larger . . .

* * *

There's a story going the rounds that one of America's leading airplane builders is hoarding gold in a legal sort of way . . . seems he has his own ideas about saving up for a rainy day . . . the story goes that, although you're forbidden to have gold coin or bricks, you are permitted to keep as much "ornamental" gold as you wish . . . with the result that this manufacturer has one of the largest collections of gold plates, candelabra, etc., we've ever heard of . . .

* * *

Out at the **Douglas** plant they have a secret that is not the secret they think it is . . . it's a twin-engined high-winged monoplane with a retractable tricycle landing gear . . . for its power (the engines appear to be two *Twin Wasps;* the props are the latest hydromatics) the ship looks awfully small . . . off-hand, we'd say it only stands about seven or eight feet high . . . there are no windows in the slim metal fuselage other than those in the pilot's compartment in the nose . . . in the air, the "mystery ship," seems to have breath-taking performance . . . we got a close look at it as it came in for a landing recently and taxied up to its closely-guarded hangar . . . there were no markings whatsoever on its single rudder or wings . . . logically, though, it looks like a possible entry in the **Army's** competition for high-speed attack bombers . . .

* * *

Consolidated also has to have its little secret down at San Diego . . . in the form of a high speed, exceedingly long range twin-engined flying boat . . . it's said that Consolidated wants to surprise the industry with this commercial ship . . . possibly by entering it in the Bendix Trophy race . . . **Consolidated,** you know, has long been arguing in favor of flying boats for the transcontinental airlines . . . then again, that company is scouting around for business, what with their **Navy** PBY contract almost up . . .

* * *

Seversky also is rumored to have a couple of experimental models he wants to submit to the **Army** . . . speaking of **Seversky,** that company has yanked itself up into such aeronautical prominence in comparatively no time at all that **General Motors** is said to be considering the company as a worthwhile investment . . . if, of course, **Major Seversky** is at all interested . . . **General Motors,** you know, already has a foothold in aviation with its **North American Aviation** . . .

* * *

Getting back to the haughty way in which the **Navy** treats the people who foot the bills the admirals run up, there's a "purge" on now against even accredited newspaper and magazine writers . . . they've all been barred from plants where **Navy** contracts are let . . . and along the same lines, the **Army** has sent out a notice to Air Corps officers directing them to refrain from discussing any **Army** defense plans with anyone outside the Air Corps . . . an Air Corps

(*Continued on page* 86)

If you plan to study mechanical work, does the school have new engines or just relics?

Choose YOUR SCHOOL Carefully

That title means just what it says, for it's not an easy task. Herewith some valuable pointers.

by DR. CARL NORCROSS

FOR most young men, the surest and quickest way to get a job in aviation is to get some specialized training. If there is a good trade school, or a technical high school in your vicinity, you may be able to get such training free. Perhaps you can secure the necessary training while working as an apprentice at an airport or aircraft factory, although such opportunities are extremely rare. Young men who are fortunate enough to live in a section such as southern California, for example, can sometimes get jobs without having had aviation training. When factories receive large orders for airplanes they cannot always get trained men.

Most young men, however, who have a strong urge to get into aviation work, and who for lack of time, money or inclination do not plan to go to college, will sooner or later give some consideration to attending a commercial aviation school. For all who can afford it, this is a much better method of preparing for a job than going from airport to airport, or from factory to factory, trying to get employment "doing anything" as a beginning job.

Aviation is fast becoming a profession like law or medicine. In the old days young men who wanted to enter such work read law in an office, or apprenticed themselves to a physician. Little by little they learned the work, and eventually they were able to pass their state examinations. But today nearly all young lawyers and doctors have gone through law schools or medical schools. The same is becoming true in aviation.

Expert mechanical men, capable of handling the latest aircraft engines in a competent manner, always are in demand. Employers aren't interested in poorly-trained men.

All the reliable schools see that their students get the best flight training.

Make sure your school has many departments and even ships for you to work on.

Photographs from Boeing School of Aeronautics, Parks Air College, Ryan School of Aeronautics.

The apprenticeship method of learning is still being used in aeronautics and it is a fine method. But your chances are very slim of finding anyone to teach you by such means.

To get a job, the quickest and most certain method for you to follow is to go to a school specializing in aviation training of the kind you want. This is a conclusion which has been forced upon the writer after he had made a tour of most of the large aviation factories, airline bases and airports of the country. Employment managers want men who already know something about aviation work. While they realize that aviation school graduates are not finished craftsmen, they also are convinced that graduates of the best schools learn the work most rapidly and efficiently.

After learning all you can about job qualifications in aviation, and as much as you can about your own fitness for such work, if you are still determined upon an aeronautical career you may decide that you can afford training in a private aviation school. But choose your school carefully and go to the best one you can find. A poor school is a waste of money. Study the advertisements in this magazine. You can send a penny postcard to the Civil Aeronautics Authority in Washington, D. C., and ask for a list of approved schools and colleges offering aviation training.

Get the catalogues of six or more schools and compare their courses. If you plan to study aviation mechanics you will find that it is offered by many schools. If you have decided upon specializing in meterology, dispatching, radio operating or some other subject which is not as popular as mechanics or piloting, then your choice of schools is more limited.

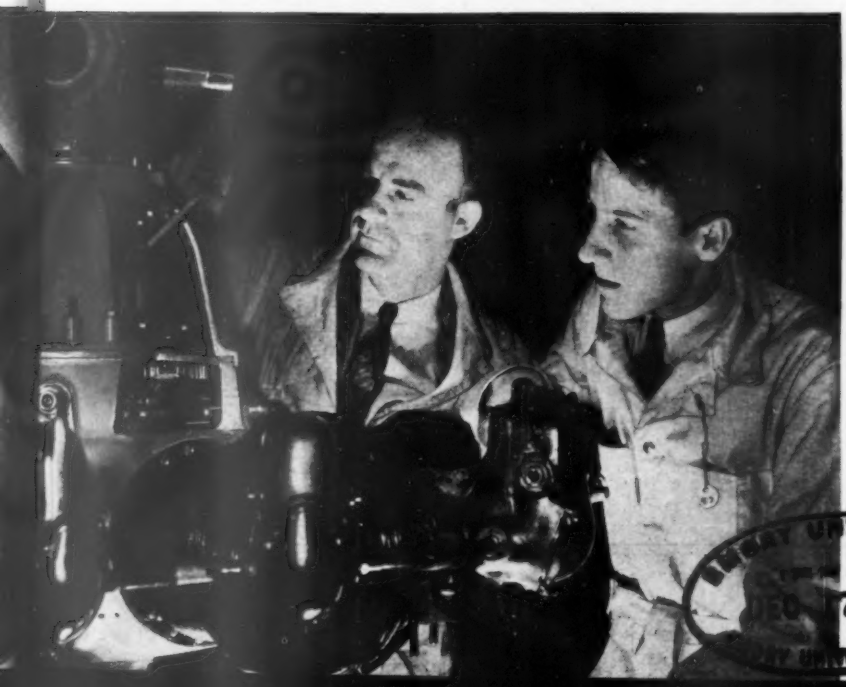
Make personal visits to as many schools as you can. If schools are some distance away, perhaps your parents could arrange vacation trips to take in several schools. If not, try to take bus trips to as many training organizations as you can. You will be able to judge a school much better by seeing it than from reading a catalogue.

After you have secured information about several schools, compare their value to you on the following points:

Reputation. Try to find graduates of the school and ask them what they thought of teachers, instruction and equipment. Are they satisfied with what they received? Ask men engaged in aviation work what they know about the school. Do employment managers give jobs to graduates? Do they think the training is basic or superficial? If there is a Civil Aeronautics Authority inspector in your neighborhood try to talk with him about schools.

Federal Government Approval. Certain schools have been approved by the government. Any school that can meet government standards is glad to do so. A school that cannot comply is not as good as one that can. But the chances are that several of the schools you will be investigating are approved. Such a fact does not mean that they are all equal. Some schools just squeeze by the minimum requirements while others pass them with flying colors.

Find out all you can about your prospective teachers and the equipment on which they instruct. Up to date engines on which to gain experience are extremely important.



School Equipment. If you plan to study mechanical work, does the school have a variety of aircraft engines or just a few old relics left over from 1920? Is the sheet metal shop modern? Are there tools such as a shear, brake, drill press, power hammers, lathes, nibbling machines, heat-treating apparatus, rivet gun and other basic equipment? Don't let anyone tell you that all phases of sheet metal work are not important. Many school graduates cannot get employment because they know nothing of sheet metal technique.

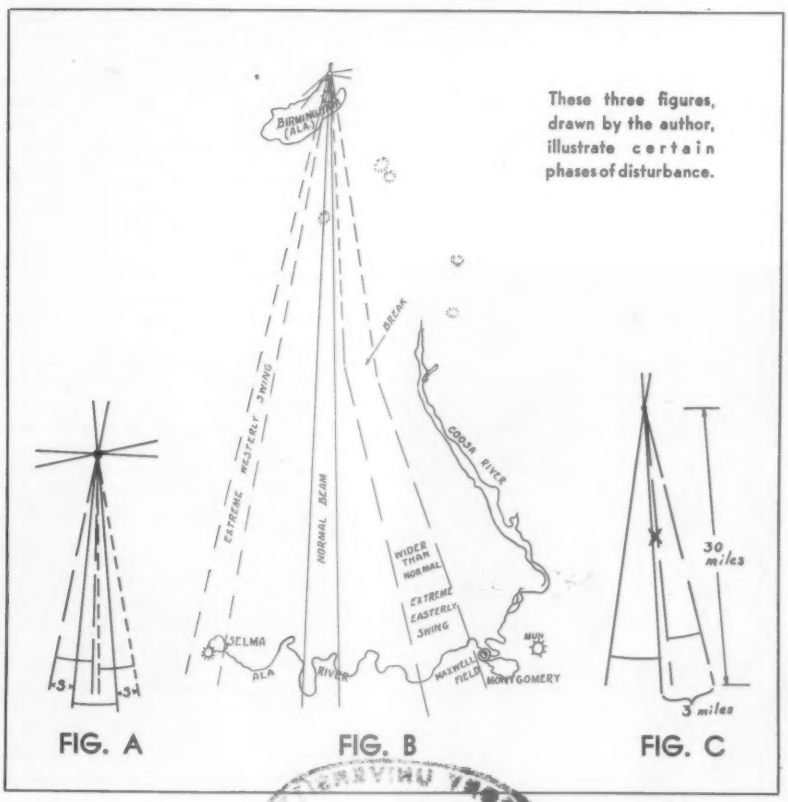
Make sure the school you choose has several different departments, including engines, wings, fuselage, instruments, welding, riveting, sheet metal, blueprint reading, radio, airbrush painting and propeller work. There should be airplanes for you to work on. An old ship is all right for teaching rigging, and some old engines have real value from an instructional point of view. But there

(*Continued on page 70*)

LEHIGH UNIVERSITY
LIBRARY
DEC 7 1951
LEHIGH UNIVERSITY, Pa.
233548

THIS "SWING" IS DANGEROUS

Above is a five-masted station from which the radio beams are broadcast. Electrical disturbances in the vicinity of these stations are responsible for "swing."



These three figures, drawn by the author, illustrate certain phases of disturbance.

FIG. A FIG. B FIG. C

NOT all swing, experienced airplane pilots can tell you, comes from dance bands. Much of it occurs on the radio bands instead, particularly that band between 200 and 400 kilocycles in which this country's radio range beacons operate. While some of this swing is slow, with lots of pauses, it is sometimes delivered hot off the station with a snap to delight the heart of any jitterbug—but not the heart or peace of mind of a pilot. Particularly when he's flying on instruments through "soup."

Imagine yourself at 3,000 feet easing up through the twilight zone of a radio range beam. You've just fixed your position by marker beacon signals from another station's intercepting beam, at about 40 miles from the cone of silence of the beam you're riding. The droning "T" with some "N" thrown in comes through the headphones. All around you is steamy fog with ceiling of 600 feet somewhere below. "M-m-m-m-m" goes the "T" overtone, about as loud as the "da-a-a-ah *dit*" of the "N" side of the beam. Your splitting 320 degrees on the gyrocompass, weaving slightly in and out of the beam's edge. Then suddenly, with no warning the "da-a-a-ah *dit*" changes to "dit *da-a-a-ah*, dit *da-a-a-ah*" with barely a sound of faithful old "T."

"Am I on top of the transmitting station?" you wonder. But you know that's impossible; you won't be there for 20 minutes or so. Maybe your plane suddenly jerked itself sideways for a couple of miles. But it can't do that, can it? The only alternative is that the beam yanked itself from under you and sashayed to the right. But can that happen? You bet it can—and more be-

EMORY UNIVERSITY LIBRARY
DEC 17 1951
EMORY UNIVERSITY, GA.

No, this isn't a musical article. It's a lot more dangerous subject than that. Many a worried blind-flying pilot has found this radio phenomena just in time to compensate safely.

by T-2003

sides. There are more tricks up that beam's sleeve than you'd ever imagine from looking at it plastered there so stationary on the airways map.

Normally, however, the swing of a beam is so slight that it cannot be noticed by a pilot in the air; only about one foot swing, or creep for every mile from the station. Figure A shows such normal creep. When the pilot is 100 miles from the station he will generally find the normal beam to be from three to 10 miles wide, depending upon the characteristics of the station, the receiver in the airplane—and himself. Thus a difference in the location of the twilight zone (the edge of the beam) of 100 feet where the beam is from three to 10 miles wide, makes little difference to the pilot.

Let us look at Figure B for an example of *abnormal* swing. This was encountered by the author during the period October 12 to November 30 several years ago. The extreme changes for any one day was seldom more than three miles where the normal beam (as shown on the map) crossed the Alabama River about 75 miles from the Birmingham station. Sometimes the beam hung in one place for four days at a time; its creep—if any—imperceptible. Most often it hung about the normal or map position, except for a creep of about one mile either way. When it swung to an extreme position to the east it had a sharp break about 35 miles from the station.

Snappy swings are most often encountered around sunset and sunrise. An extreme degree of such swing may be as shown in Figure C and may occur within several seconds. The pilot might be flying blind several miles from the station and the rapid changes of signals received due to such swing would lead him to believe he had overcontrolled and flown across the beam where it was extremely narrow, near the station. In other words, the pilot might be deceived into thinking he was almost on top of the station and had just barely missed the cone of silence. Imagine yourself being at position "X" on this diagram when the beam suddenly snapped to one side.

Multiple beams, and bends, occur in mountainous country. Bends also occur where the beam converges on a railroad or power line, as the beam has a tendency to parallel such lines. A bend is seldom more than 45 degrees in amplitude, shown in Figure G. As the beam sometimes dislikes to hurdle mountains, it may deviate from its course, but will do so far enough back from that mountain so that a sharper bend than 45 degrees is unnecessary, the beam being more foresighted than some pilots.

Multiple beams are confusing; bends should not be. A bend should give little more trouble to the pilot than a shift in the wind. Indeed, the author once mentioned a severe wind suddenly springing up aloft after he had faithfully followed a beam over the top. The meteorologist to whom he reported this wind phenomenon was justly puzzled, but a nearby airline pilot familiar with the route explained to both of us that the change in compass heading required to follow the beam had been occasioned by a sharp bend in that beam and not by crabbing in a strong side wind.

Multiple or feathering beams are confusing, especially where their presence is not suspected. Imagine yourself flying through the soup following the twilight zone of the beam as shown in Figure D or Figure E. Airplane pilots encounter such conditions and usually realize what has happened. They have had previous encounters with such a phenomenon or they have had reports from their mates as to where they are most often encountered on a mountain run. Airline pilots also have recourse to radio compasses and marker beacons and can locate their positions rather accurately when or if the regular beams go haywire, as shown in the above two diagrams. Of course, if one knew accurately the pattern such split or feathering beams would follow he could discount much of the jumbled sounds heard in his earphones and eventually he could pick up the true beam and follow it in to the station. Such splits, however, seldom follow a regular pattern.

In Figure F we see several conditions which result when the beams deviate from their normal 90 degree relationship to an extreme degree. Beams Nos. 2 and 4 in this diagram are unusually narrow. Sometimes all four beams are unusually narrow. Sometimes a narrow beam will widen at a distance from the station as at "B" in diagram. Quite often we find narrow cones of silence keeping company with narrow beams, and even irregularly-shaped cones of silence. In Figure F the pilot flying along beams Nos. 1 and 3 toward the station encounters a normal sized cone of silence for a given altitude. Flying along beams Nos. 2 and 4 he comes on such a narrow cone of silence as to cause him to miss its brief interruption to the sound of the beam.

Let us suppose the pilot is flying along beam No. 2 toward the station. The beam, being as narrow at eight miles from the station as most beams are at four miles therefrom, might lead him to believe himself close on the station. He would therefore be looking for the cone of silence several minutes before he was actually due over the station. By the time he had flown to the cone he might conclude he had already passed it. At a low enough altitude he would not be able to detect the narrow cone, as its very brief silence might occur between

(*Continued on page* 83)

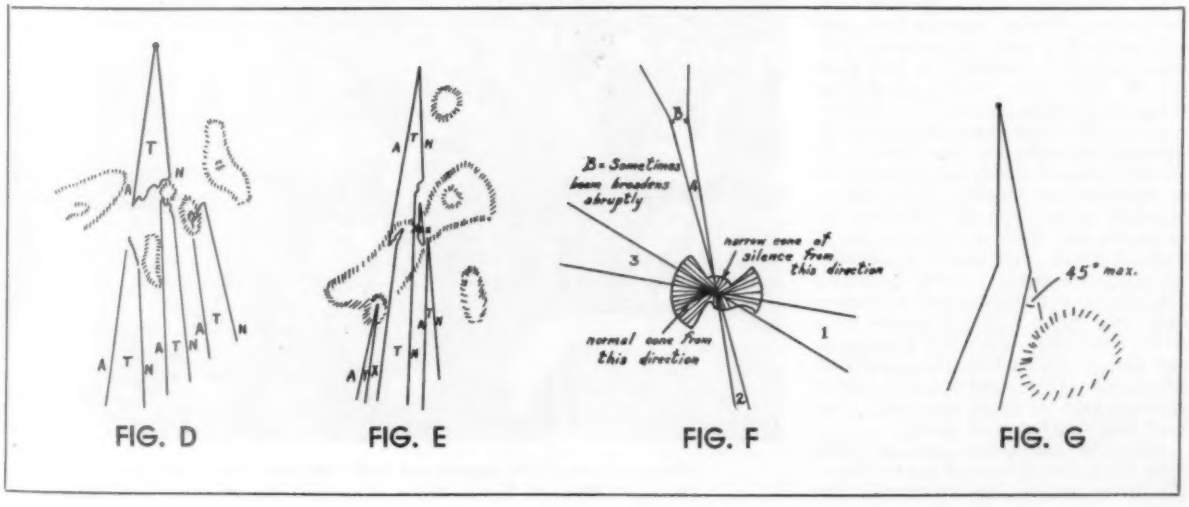


FIG. D FIG. E FIG. F FIG. G

This recent flood picture graphically shows the susceptibility of railroads to sudden calamity. Again, aircraft saved the day.

The currents around this flooded farm were so strong that only an airplane could reach the place until the swirling waters quieted.

WINGS FOR THE

by KURT RAND

The airplane has done far more mercy work than the bomber has done bombing. Many unsung rescues and life-preserving missions have been flown by Red Cross planes

SINCE 1925, when aviation was first begun to be used by the American Red Cross, the organization and its workers have come to rely increasingly upon the services which the airplane provides. Rapidity of transportation, both of personnel and materials, is but one of the advantages which it offers. As a means of communication between isolated workers or refugees and Red Cross regional headquarters, aviation offers another advantage. It is further relied upon for surveys of devastated areas, for determining the extent of damage, and for calculating the probable requirements of the stricken districts.

During the height of operations in the Ohio and Mississippi Valleys in 1937, Red Cross headquarters at Memphis, Tennessee, had 14 planes and one blimp working from that city over inundated areas. Many other planes operated from the various district headquarters. Not only were they used for carrying messages and relief workers, but they made periodic observation flights, directed the rescue of isolated victims, watched the course of the flood, reported progress of workers strengthening the levees, and provided a rapid means of transportation of medicines and supplies, quick delivery of which might spell the difference between life and death to many people. A flight in one of these planes on observation duty is a thrilling event. Swooping low over the turbulent yellow waters, sometimes rising to great heights for a wider view, they direct the rescue craft and bear a responsibility weighted with human life. The forces of nature on the rampage calls for speed in action, a clear head and long hours of work.

Stretched out below are thousands upon thousands of acres of water. Where the levees guarded the riverbank there

Above are some of the supplies and food assembled in an airport hanger during the recent Ohio river floods. Dozens of airplanes flew them to isolated sections.

Red Cross officials usually turn to the military services first when they need aircraft for emergencies. Above is an Army transport that was used as an ambulance to fly disabled people to aid.

RED CROSS

are what appear from the height to be but faint ripples over the yellow surface. Here and there the top of a levee forms a spear-shaped strip of island. Shacks and houses go rolling along the surface like tumbleweeds before the wind of the western prairies.

Far in the distance the pilot sees a group of housetops and heads in that direction to see if the ships of mercy have any work to do over there. As he approaches, the faint outlines of people clinging to the roof-tops are made out. The plane swoops low overhead and with a friendly wave, the stranded victims are told their plight has been observed and rescue will soon be on the way.

Army bombers and observation ships also drop supplies from bomb racks like this.

The radio then comes into play and one of the mother ships that ply the river is advised there is work to be done. Accurate directions are given and within short order a motorboat is on the way. Those that were marooned are taken aboard, shivering but happy, and returned to the mother ship, there to be cheered with food and warmth before being landed at a refugee center. In the meantime, the plane has sped to another area, observing progress, keeping careful watch over the workers who have the job of strengthening the levees, and spotting every refugee within sight. Suddenly a signal comes over the radio: Return to base.

Without loss of time the plane wheels about, pilot and observer take a last look at the flooded farm lands, and the plane speeds off in an easterly direction. Soon they step from the plane at the airport. Here everything is feverish activity. Mechanics are going over engines, planes are being refueled, others are taking off and arriving with supplies at all hours. A large white banner with a red cross waves over the field's administration building.

The word goes out that two planes must take off immediately for a spot on the other side of the flood where an epidemic is threatening. Already an emergency hospital has been established, and if the threat becomes a reality, it will be serious business. Preventive measures must be taken without delay. One plane will carry medical personnel, the other anti-typhoid and other prophylactic vaccines. These latter are yet to come from Walter Reed Hospital in Washington where they are being manufactured at high speed and shipped out as soon as ready.

Shortly a plane circles overhead. It has the army insignia and doubtless is the expected one from Washington with the medicine. As it lands and taxis up the field, several men with Red Cross brassards run to meet it. Sure enough, it is from Washington and is bringing the vaccines. Another plane with an additional consignment is to come in soon, the pilot announces. Without loss of time the load is transferred to a waiting plane, that ship with the medicos is ready and they both take off and head in a northwesterly direction.

In the meantime activity has begun to show itself over by the blimp. Busy people are going back and forth and shortly the blimp begins to rise, soon to disappear to the south beyond the crest of the flood, where men are still working with sandbags in an effort to stem the rising tide. Slowly the water creeps higher along the sandbag breastwork and feverishly the men pile bags one atop the other, backing these up with a second, a third, and still more rows.

The blimp noses down on one of these toiling gangs. It slows and hovers six feet above the heads of the men. This section will have to be cleared, they are told, and rescue boats will be along shortly. A break further up the river has flooded part of the back country. Retreat

from the levee, except in a roundabout direction, is impossible. This is no time to be trudging through back country and marshy fields when their labor is needed elsewhere. A few further words are passed, the men are again assured that rescue is on the way and will arrive shortly, and the blimp starts off for another crew to tell them their work has been in vain.

Disaster relief operations generally are divided into two phases: the emergency and the rehabilitation period. It is during the emergency period that the services of aviation come most prominently into play, although they are used during both phases. The early period is marked by dramatic rescue work. Great masses of people are moved from their customary abodes and concentrated in refugee camps. The necessary shelter, food, and clothing, along with medical aid, must be made available to every family. Refugees are inoculated against the outbreak of epidemic. When such is threatened, emergency hospitals are quickly set up, apart from the main camps, to house the sick, while suspect families are isolated until all danger is past.

During the past year the Red Cross has availed itself extensively of Pan American Airways' trans-Pacific service in furnishing relief in China. Money, of course, can always be transferred by cable or wireless, but under the conditions confronting the relief workers in the Orient, money is sometimes of no value, as the materials needed are simply not available in the Far East. It is then that the Red Cross calls upon the Pan American Clippers. At Red Cross national headquarters a request is received by radiogram from those in charge of relief in Shanghai. Instruments, antitoxin and anesthetic masks are imperatively needed. Red tape has been eliminated. It takes no time to put an O.K. on the request. Several hundred miles away the sales manager of a company manufacturing medical and doctors' supplies, sits at his desk. His phone rings. "This is the Red Cross in Washington," a voice comes over the wire. "It is imperative we get 15 fitted surgical cases, 25,000 doses of tetanus gas gangrene antitoxin and 100 anesthetic masks aboard the next *China Clipper*. Can you do it?"

The sales manager gets busy. Quickly he figures the time allowed him to fill the order and ship it some 2,000 miles across country. With luck everything will be packed and ready to go that same day. But luck or no luck, the stuff must go out, even if it means he has to stay and supervise the job himself.

So the stuff goes out. It goes aboard the late plane and gets to 'Frisco in plenty of time. And medicines and surgical instruments that were reposing in the storeroom of a warehouse in Detroit hardly more than a week earlier, are being used in far-off China, bringing relief from suffering to refugees and wounded, preserving the lives of thousands and affording renewed hope and courage to the heavy laden.

During the past summer, when an epidemic of cholera broke out in China, the Red Cross ordered 1,000,000 doses of cholera vaccine. Much of this was delivered by air as the need was urgent and the supply at hand was virtually nil. Anti-typhoid serum is another item that has been shipped by plane to the Far East.

Goods for which the need in China is urgent are sped by airliner from San Francisco. Careful watch is kept on connecting schedules so that when the Red Cross has occasion to send supplies, they will not arrive at the dock after the Clipper has started its journey. Other materials, such as absorbent cotton, adhesive plaster, and bandage gauze, are shipped by boat, the supply being maintained by frequent and steady shipments.

As this was being written, United, American, TWA and Eastern Airlines

(*Continued on page* 87)

Here are supplies being loaded aboard an old Army cargo ship during a national emergency several years ago. Aircraft are greatest help in rushing serum to stricken areas.

Production Up

INDICATIVE of the degree of prosperity being enjoyed by the aircraft industry this year is the increase of 47 per cent over year earlier levels recorded by first half production of planes, engines and parts. Exports for the period comprised 48 per cent of total output and were 128 per cent greater than a year ago; June exports were up 205 per cent from June, 1937. Activity of the CIO and attendant strike threats, together with reports of material shortages, are the main contingencies standing in the way of an unabated rate of activity throughout 1938 and into 1939. Earnings expansion has quickened, and at last is in more normal proportion to gains in output. Retardation of the enlargement of profit margins may result from possible wage increase demands by employees, or from the Public Contracts Board recommendation that a 60c minimum hourly wage be imposed on all military plane producers. On the favorable side, however, is the growing recognition that the Army procurement methods should be altered to conform with the Navy policy of assuming a major share of development costs on military ships.

Poor Percy

LITTLE PERCY was left aboard a London-Paris airliner of Imperial Airways recently.

When it became generally known that the lonely little fellow sadly awaited his absent-minded owner in the airline's lost and found department, many kind-hearted Britons wrote and telephoned the airline, offering the little waif a home. One loving soul even went so far as to see that Percy was supplied with a soul-inspiring meal of ant's eggs. Imperial Airways officials, however, are thorough. They will not give up the little tyke until every possible means of locating Percy's home has been exhausted. Then it is quite probable that Percy will go to the home of one of his admiring aviation benefactors.

Percy is a goldfish.

Is This You?

HEY, pilot! Be a good sport and take that lead weight off the end of your radio antenna.

The Aero Insurance Underwriters, in their regular bulletin, warn of the dangers involved in the use of the lead weight to hold the trailing antenna steady in flight. Through constant use, the antenna wire eventually breaks under strain and drops the weight. From any appreciable altitude that tiny weight could easily plunge through the roof of a house or an automobile—or a hat. It is recommended that a light canvas sock, similar to a tiny airport wind sock, be used. It weighs only a few ounces.

Centralized Power for Aircraft?

by JAMES P. EAMES

The problem of multi-engined equipment is an important one, especially to those who intend running feeder services with comparatively small aircraft. Is this the answer?

SEVERAL proposed designs for large passenger transport airplanes, as well as for large military bombers, are projected for the immediate future. All of these airplanes are of the multi-engines type, some of them supporting as many as six power-plants faired into the wing roots.

Undoubtedly, admirably progressive engineering work has been done relative to drag reduction in isolated radial aircraft engines located in wing mountings through the medium of cowlings and thickened airfoil sections, but how far can the designer go along the lines of the present trend?

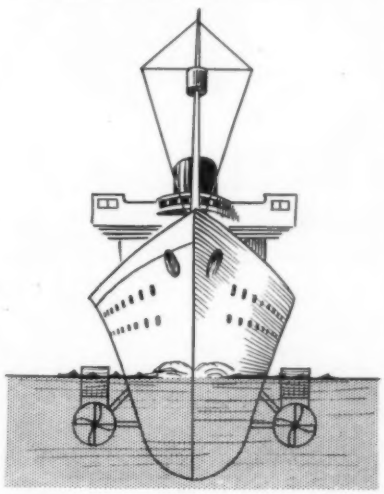
What, if any, is the limit to the number of independent power plants which may be spaced along the wing span? Will we shortly see the era when the main fuselage structure will house a central power plant of large output equivalent to that of several smaller units more inaccessibly located.

The form of transportation closest to the heavier-than-air craft is probably the ocean-going vessel. The similarity is based upon the fact that the propellers of both types of craft operate in a fluid medium, but are subject to some considerable difference in the viscosities of the two mediums. Nevertheless, the problem of securing adequate propulsive equipment and its installation assumes equivalent solutions for both the ship and the airplane.

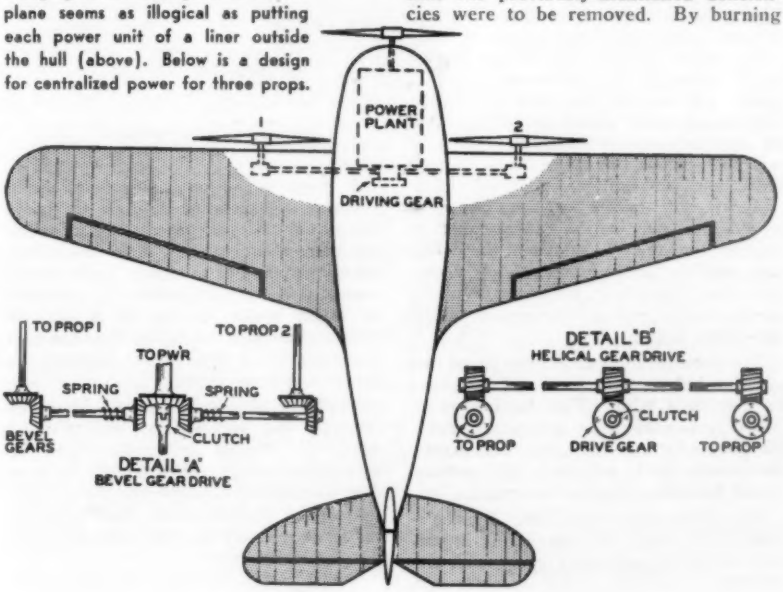
The front elevation of an ocean-going vessel is illustrated by Fig. 1, one that would readily provoke considerable adverse criticism. When applied to the case of the ship, the factor of overcoming the enormous amount of drag presented by immersed outboard engines becomes immediately apparent. Is not the same condition encountered in the case of the conventional multi-engines airplane?

Prior to proceeding with a brief analysis of the comparative merits of the central power-plant and multiple outboard engines, the various fundamental factors underlying the choice of aircraft power plants in general are outlined below. As we progress we will endeavor to determine the degree to which either type of installation tends to comply with these basic performance requirements.

1. Fire hazard.
2. Weight per developed horsepower.
3. Overall drag.
4. Production cost.
5. Operating cost.
6. Reliability.
7. Accessibility.
8. Type (radial or in-line) (air or liquid-cooled) (gasoline or Diesel).
9. Reduction between engine and propeller speeds.
10. Proportion of airplane structure space devoted to engine and its accessories.
11. Torque characteristics.
12. Vibration.
13. Provision for adequate fuel and oil systems.
14. Installation of suitable cooling systems.
15. Synchronizing of multiple engines.
16. Exhaust disposal system.
17. Provision for accessory devices.
18. Provision for ordnance equipment on military aircraft.



Hanging outboard engines on an airplane seems as illogical as putting each power unit of a liner outside the hull (above). Below is a design for centralized power for three props.



Fire hazard represents, perhaps, one of the principal adverse factors affecting both scheduled and non-scheduled airplane operations at the present time. The remarkable mechanical efficiency, coupled with low values of weight per horsepower, attained by current designs of aircraft gasoline engines unfortunately insures their employment in the field of air transportation for some time to come.

The compression ignition engine, burning the heavier hydrocarbons, is some improvement from the standpoint of reduced fire hazard but lacks the flexibility, the reliability and the low weight-horsepower ratio of the gasoline engine of comparable output. However, ample evidence has been presented to indicate that the above-mentioned discrepancies are by no means unsurmountable.

Nevertheless, conditions being as they are at present, high test aviation gasoline will probably continue to be the main aviation fuel for the immediate future at least. The fire hazard thus presented is a difficult problem regardless of the distance of the power plants from the occupants of the airplane, if we are to judge from the reported accidents of recent months.

Consider, on the other hand, the possible advantages emanating from the installation of a large central power plant delivering from 3,000 to 5,000 horsepower. This unit would, in all probability, be of the Diesel type, assuming that the previously-mentioned deficiencies were to be removed. By burning

heavy fuel, a reduction in fire hazard is effected.

It is not likely that air cooling would be resorted to for such a large faired unit, as it would necessarily be, into the fuselage structure and thus removed from the propeller slipstream and the relative wind encountered in normal flight.

It is also doubtful whether the conventional forms of liquid and chemical coolants would prove adequate for the problem involved. The logical solution would be the installation of an evaporative or steam-cooled system.

This arrangement is adequate for engines of high horsepower output. Among its other advantages it possesses low overall weight, occupies comparatively small space and the heat generated within the radiator can be readily employed for the purpose of heating the interior of the airplane at high altitude. A typical aircraft engine evaporative cooling system is illustrated by Fig. 2. its action being indicated thereon.

The engine is cooled by water during flight conditions entailing low values of forward speed, as, for instance, in climbing. This condition also applies during the warming up period. In the course of flight at high and cruising speeds, the radiator is retracted and its water consequently converted into steam upon circulation throughout the heated engine.

Expanding into the condenser, the steam is subsequently cooled and condensed by the propeller slipstream which is directed against the condenser unit. The heat transformation accompanying the process of condensation functions in cooling the power plant.

The additional reliability gained through the employment of multiple engines is offset to a large degree by the better accessibility of the centralized large output power plant. Assuming, as above, the employment of the Diesel-type engine for our hypothetical large power plant, added reliability is incorporated since individual fuel pumps would be provided for each cylinder.

Temporary failure of any one unit would not necessarily cause complete engine stoppage. In addition, the defective member would be completely accessible for immediate repair or replacement without undue interruption of the scheduled flight.

The problem of synchronization of two or more independent power plants could be dispensed with. The duplication of items such as nacelle structures, cowlings, engine controls, engine instruments, accessories and fuel and oil systems would be automatically eliminated.

The first-mentioned item of nacelle drag is, of itself, of tremendous importance since it increases rapidly with the increase in overall engine diameter and also with the increased speed of the airplane.

As power output tend to increase progressively in order to remain abreast of commensurate advances in the size of airplane structures, engine diameters will naturally tend to expand in proportion. This condition could be minimized somewhat by progress in the design of multiple cylinder bank radial power plants or by the reversion to the in-line engine.

In either event, the central powerplant still remains superior since only minute excrescences would be required to fair the propeller drive shafts into the wing sections, the drag resulting from their use thus being merely nominal in comparison with that offered by the present outboard engine nacelle.

"He used to be a test pilot . . ."

In view of the fact that an increasing number of accessory devices are being driven off the main power-plants, including de-icer equipment and engine-driven vacuum pumps to motivate flight instruments, it becomes increasingly advisable to group these devices in a position where they will be under the constant supervision of the flight engineer in larger types of aircraft.

Visibility should be greatly improved through the removal of engine wing nacelles. This factor, coupled with the attainment of an increased arc of gunfire, would tend to influence the adaptation of the central power plant principle for large military airplane designs of the bombardment type.

A derogatory factor of considerable importance arises due to the fact that a large proportion of the space usually devoted to the accommodation of passengers and cargo must necessarily be diverted to the housing of the central power plant and its accessories. However, an airplane sufficiently large to be powered by our hypothetical engine would, in all probability, incorporate airfoil sections of considerable thickness, thus permitting the wings to serve as auxiliary accommodation areas.

The remaining factors of exhaust noise and disposal, torque load influence and vibration exist roughly in the same proportion as do those emanating for the employment of gasoline power plants of equivalent total rated horsepower output.

The choice of suitable propeller shaft drives for the central power plant entails engineering and structural investigation of considerable complexity. Shafts, fitted with suitable universal joints could be employed after the manner illustrated by Fig. 3. The Rizeppa joint would lend itself admirably to this type of installation. This device permits the maintenance of 100 per cent propulsive efficiency for a shaft displacement up to 7 degree from the centerline of the power plant. Displacements up to 12 degrees from the engine centerline will permit the shaft and joint to function with a propulsive efficiency of 92 percent, or with a drop of only 8 percent from that attainable with a straight shaft.

This design could also locate the central power plant to the rear of the passengers. Although somewhat of a departure from conventional practice, this arrangement has been followed by Koolhoven in Holland for military designs, notable success having been thus achieved.

The exhaust disposal system is greatly simplified and functions with a minimum of annoyance to the occupants of the airplane. Visibility is somewhat improved over that obtainable with designs following the dictates of conventional practice.

An obviously bad feature of the illustrated design involves the extensive unsupported lengths of the propeller shafts, this deficiency giving rise to the attendant possibility of troublesome shaft whip.

Ample provision, however, can be made for the installation of suitable bearings along the effective length of the propeller shaft. Provision must also be made for the periodic maintenance and inspection of the shaft and its housing.

The entire removal of this assembly for replacement or repair presents a problem of greater proportions than that involved with the removal of a complete outboard power plant from its wing mounting.

(*Continued on page* 68)

SAFETY IN SPINS

by CONRAD J. MORGAN

The tail spin used to be the most dreaded maneuver an airplane could fall into. But constant study and engineering have wiped out the mystery, making spins safe.

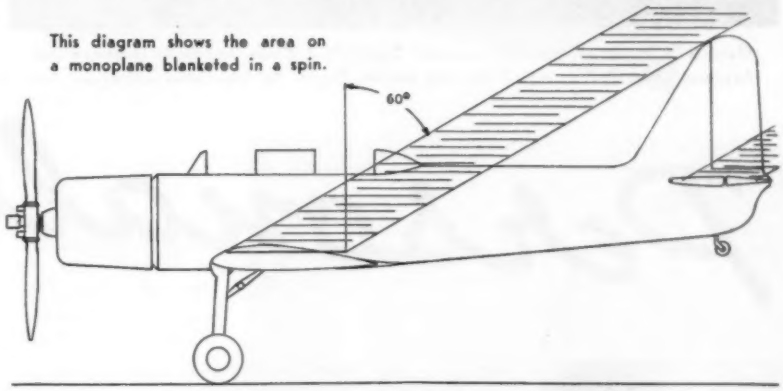
SPINS used to be dangerous and they still are in ships built by the hit or miss method. Sound engineering, not the natural passage of time, has erased most of these dangers. The cause of spins—autorotation—is easily understood. The wing stalls, due to lack of flying speed. One wing drops, usually the one against the direction of rotation of the prop. The nose then drops. This action brings the high wing ahead with a resulting increase in speed and lift while the low wing is forced back causing it to stall worse than ever. You have in effect then, only the high side of the ship flying while the low side adds only drag. This causes the ship to spiral without any aid from the rudder. The result is a tight spiral with the angle of descent in the neighborhood of 60°.

The more turns you make the tighter the spiral due to increased speed. As the spiral is tighter the inside wing is closer to the center of the circle and while it is revolving at a greater number of revolutions per minute the wing is not necessarily traveling at any greater speed. The only method of recovery is to stop the rotation and remain in the resulting dive until flying speed has again been reached.

The ailerons are of no use in a spin as they are ineffective beyond the stall. As the tail is swung around in a comparatively large circle the air speed past the tail assembly is relatively high. The rudder, then, still has flying speed and as it is almost broadside to the wind it becomes the most, in fact the only, effective control left and if it is moved against the direction of the turn it will stop the spinning provided: here is enough rudder area to overcome the spinning couple, and what rudder you do have is not blanketed and made ineffective by the horizontal tail plane and/or the wing.

The latter is very important. In biplanes and low wing monoplanes with comparatively short tail lengths, the low wing often blankets the rudder. High wing and parasol monoplanes are not affected in this manner. To check your ship for this draw up a side view of your ship to scale and from the trailing edge of the mean chord of the low wing project a 60° angle upward and to the rear extending this line past the rudder. An example is shown in the drawing. If this line cuts any part of the fin or rudder that part above the line should be considered ineffective as it would probably be within the blanketed area. Now project two lines from the leading edge and trailing edge of the mean chord of the horizontal tail plane. It might be added that this is 60° to the vertical, not the horizontal. All the area between these lines should be considered ineffective. This usually leaves very little effective rudder with the conventional tail assembly. If any of the fin or rudder of your ship is within the area blanketed by the wing the tail should be lengthened until it clears.

There are several ways of reducing the area blanketed by the horizontal tail plane. Probably the most common is to put as much area as possible below the horizontal tail plane. Making sure that this area plus the area above the blanketed portion of the rudder is sufficient for recovery. Two methods becoming incresingly popular are to raise the horizontal tail plane up on the fin or to move the fin and rudder forward so that the hinge line of the rudder is in line with the leading edge of the horizontal tail plane. This will probably make it necessary to again lengthen the tail in order to clear the fin and rudder. This latter method is finding favor in the new military ships. The *Flying Fortress* is a good example.



This diagram shows the area on a monoplane blanketed in a spin.

An intentional spin is caused by throttling back on the engine, pulling the stick back so that the ship climbs with power off. Then, just as the ship stalls, pull the stick all the way back and kick hard rubber. Holding the stick back completes the stall and kicking rudder swings the tail around. As the center of area is well back on the fuselage the nose drops and the spin is started.

Accidental spins are usually caused by trying to make a turn while gliding at too flat an angle, coming in for a landing with not enough speed and maneuvering at high altitude. And that brings up something else, remember that you can fly at a lower speed at low altitude than you can at high altitude. However, though, the air speed indicator reading will be approximately the same. If you have sufficient flying speed the ship will not spin. This is the best assurance you have of not spinning. If you must do a few spins get plenty of altitude before trying your luck.

Recovery from a spin is simple: the stick is pushed forward and opposite rudder is given. The theory is that if the ship is spinning tightly to the left, you use right rudder much the same as you would use right rudder in normal flight to come out of a left turn. As the stick is forward this puts the ship in a dive in order to regain flying speed quickly. As soon as flying speed is reached the stick is pulled back until the ship is again flying level and the throttle is opened. A properly designed ship will recover in less than two turns when the controls are placed in neutral.

For rapid recovery from a spin it is necessary to have a large amount of rudder area in proportion to the fin. Unfortunately, a small fin with a large rudder also hastens entry into a spin. But if enough fin area is put on the ship to prevent entry into a spin, recovery from an accidental spin would be difficult if not impossible.

The minimum vertical tai larea necessary for stability is given by the following formula: $S_{vm} = \frac{X_t S_t}{2L_t}$. Where X_t is the distance of the airplane center of gravity aft of the aerodynamic center of the fuselage. S_t is the side area of the fuselage. L_t is the tail length from the center of gravity to the hinge line of the rudder. And S_{vm} is the vertical tail area to be found.

The following formula expresses the idea that a certain amount of vertical tail area is necessary for stability and an additional amount for quick recovery from a spin. $S_v = \frac{0.02bS}{L_t} + S_{vm}$. Where b is the

(Continued on page 86)

General H. H. Arnold recently presented Capts. C. J. Crane and G. V. Holloman and Raymond Stout (left to right) with the Mackay Trophy for their blind-landing system.

Major Victor E. Bertrandias is Douglas Aircraft's export sales vice-president.

Personalities

United Stewardess Dorothy Herren and Crew Chief Edmund Schroeder loved to sail together, were married recently.

Left are C. B. Allen with R. T. Freng of United Air Lines. Allen recently joined the Civil Aeronautics Authority.

Major J. C. Stewart of Britain's Air Ministry, is studying U. S. airline operations.

Ray Elsmore, assistant chief pilot for Western Air Express, once was a bishop.

Jack Herlihy has been named vice president in charge of operations for United.

This is Col. Edgar S. Gorrell, publicity-shy head of the Air Transport Association.

Charles Peterson, world champion billiard shot, demonstrates smoothness of flying by balancing three billiard balls on a small table in flight.

Rev. George Madden of Los Angeles celebrated his 80th birthday by taking his first flight. He and Mrs. Madden were guests of city officials.

Charles Johnson, retired machinist, is 62 and flies his own airplane. Johnson has been flying for six years, made his first solo flight when 56.

Letters

Thanks!
Sirs:

I have had the pleasure of reading POPULAR AVIATION now for a couple of years. I have seen no publication which has shown such a splendid and constructive improvement in the couple of years as has your good magazine. You have done a good job of making it interesting and readable. Congratulations.

C. R. SMITH,
President.

American Airlines, Inc.,
Chicago, Ill.

Who Said Cheap?
Sirs:

I have just finished reading from cover to cover your December issue . . . and am able to digest a number of things printed therein, but there is one article that would choke any sane person, namely "Flying Is Cheaper Than Driving" by Robert Cummings . . .

It is strange how so many people think that they can learn to fly in a few short hours (and well enough to teach someone else, at that) when it takes several hours to learn to do the natural things such as walking, eating and other things that nature designed man to do. Even the birds have instruction and don't jump on the edge of the nest and fly off after a worm without some tutoring. . . . It is not hard to find so-called pilots with instructors' ratings who will give time to anyone that comes along for $1.50 to $5.00 an hour, as the article states, but take a look at this so-called bargain and consider a few things. First the pilot-instructor no doubt owns his ships and is fooling himself into believing that he can fly it for this small amount since he knows so little about an airplane as to believe that gas and oil are the main items . . .

If the student is 20 years old (the instructor), is trying to work into that student in a few short hours a third perspective with the two dimensions that the student has been seeing things in for 20 years, as well as adding the factors of time and speed, hearing, balance and feel. His eyes are compelled to go through changes concerning periods of time and focus . . . How many of the two-bit-an-hour instructors have had their records investigated and have been approved as qualified instructors whose students may obtain insurance policies through the Aero Insurance Underwriters? Twelve out of 15 accidents (all but one or two were fatal) reported upon in the September issue of a certain publication were pilots and equipment of the $1.50 to $5.00 class. Flying calls for care and not courage, so the next time that Mr. Cummings has students to solo let him send them off with something more in their heads than water which is trickling down their cheeks in tears . . .

W. K. OWEN.

Union Air Service,
Burbank, California.

• We'll stay on the fence. Perhaps Movie Actor-Pilot Cummings would care to answer Mr. Owen?—Ed.

Who's Right?
Sirs:

In your December issue . . . you stated in the article "Stunt Special" that Tex Rankin bought his Great Lakes ship from Eva Hauptman of Gardner, Montana. You are wrong there because, before Mr. Rankin bought the ship, it was owned by Tom Kocher of Sunburst, Montana. He owned the ship for over a year previous to the time Mr. Rankin bought the ship.

PAT MCDONOUGH.

Shelby, Montana.

• Will Tex Rankin please clear up this minor dilemma?—Ed.

"Now are you convinced that it wasn't the cigarette lighter you pulled?"

Something Surely Would!
Sirs:

. . . A thought came to me while reading "The Future of Our Air Force" (POPULAR AVIATION, October and November, 1938) . . . concerning the blotting out of cities during an air raid . . . If an air raid was in progress and the surrounding cities were notified of it, why couldn't it be possible to warn the people and, beforehand, to furnish them with some sort of smudgepots to be burnt in their stoves or furnaces? No matter which way the wind is blowing a city could easily be blotted out . . . Just think what a little smoke from a train does or even a small bonfire. Multiply that by 100,000 or more and something surely would be blotted out . . .

HOWARD KEIL.

Buffalo, N. Y.

Brickbat
Sirs:

If you propose publishing articles such as "This Transatlantic Poker Game" (POPULAR AVIATION, December, 1938) in the future, I would suggest that they be announced as fiction in order that your reputation for veracity shall not be damaged.

P. C. GARRATT,
Managing Director.

The De Havilland Aircraft
of Canada, Ltd.
Toronto, Canada.

• Facts for POPULAR AVIATION'S article came from American aviation men who have dealt first-hand with the situations described since transatlantic airlines were first projected. We are sure, too, that these men have much more important work to do than to take time to concoct patriotically vicious propaganda. Though Reader Garratt gave none in his letter, we would appreciate his constructive criticism.—Ed.

Good Advice
Sirs:

I am a lad 18 years of age, who, like many other fellows, in plugging along trying to get some education in the aviation field. Up until I was 16 I went to some airport and watched the planes for hours at a time. One day a pilot told me to subscribe to POPULAR AVIATION. This I did and, in the last two years, I have learned more about aviation than in the first 16 years of my life . . .

ARNOLD NIEUWENHOFF.

Worcester, Mass.

We'd Call That Fast
Sirs:

In your very interesting October number . . . I read your article "Spitfire" and I would like to know what your American pilots call a fast plane. The *Spitfire* (standard version) flew from Southampton to Croydon in 7½ minutes; the distance is 48 miles. This can hardly be called sluggish. In (your Letters department) of the same issue a reader says the *Hurricane* can attain a speed of 408 m.p.h. It not only can attain that speed but has averaged it for 327 miles . . .

W. ELDER.

Isle of Man,
England.

Pacifist
Sirs:

Permit me to say a few words re-

(*Continued on page* 68)

The Science of Streamlining

by RAOUL J. HOFFMAN

This is one of the most interesting phases of modern aerodynamics. The author covers the subject with understanding.

THE performances of high speed airplanes depend entirely on parts that are in no way lifting the plane. Numerical values indicate that at very high speed the power required to lift the plane is only a few per cent of the total power expended; consequently it may be surmised to dispense—and there is a tendency to do so—with those non-lifting parts. Naturally this radical procedure is not as simple as it may appear. Nevertheless great strides have been made in the last few years by eliminating the worst offenders.

Let's investigate the aerodynamics of an airplane in general. We find that the drag necessary to keep the plane in the air is nothing but the resistance of the mass of air being pushed downward. This reaction, the induced drag, decreases with higher speed and larger wing area. Still the wing itself has a resistance, depending on its design, its thickness and on the texture of its surfaces, which is called the profile drag. The profile drag is assumed to be constant over a large range of angles of attack. The remaining parts create the structural or parasite drag.

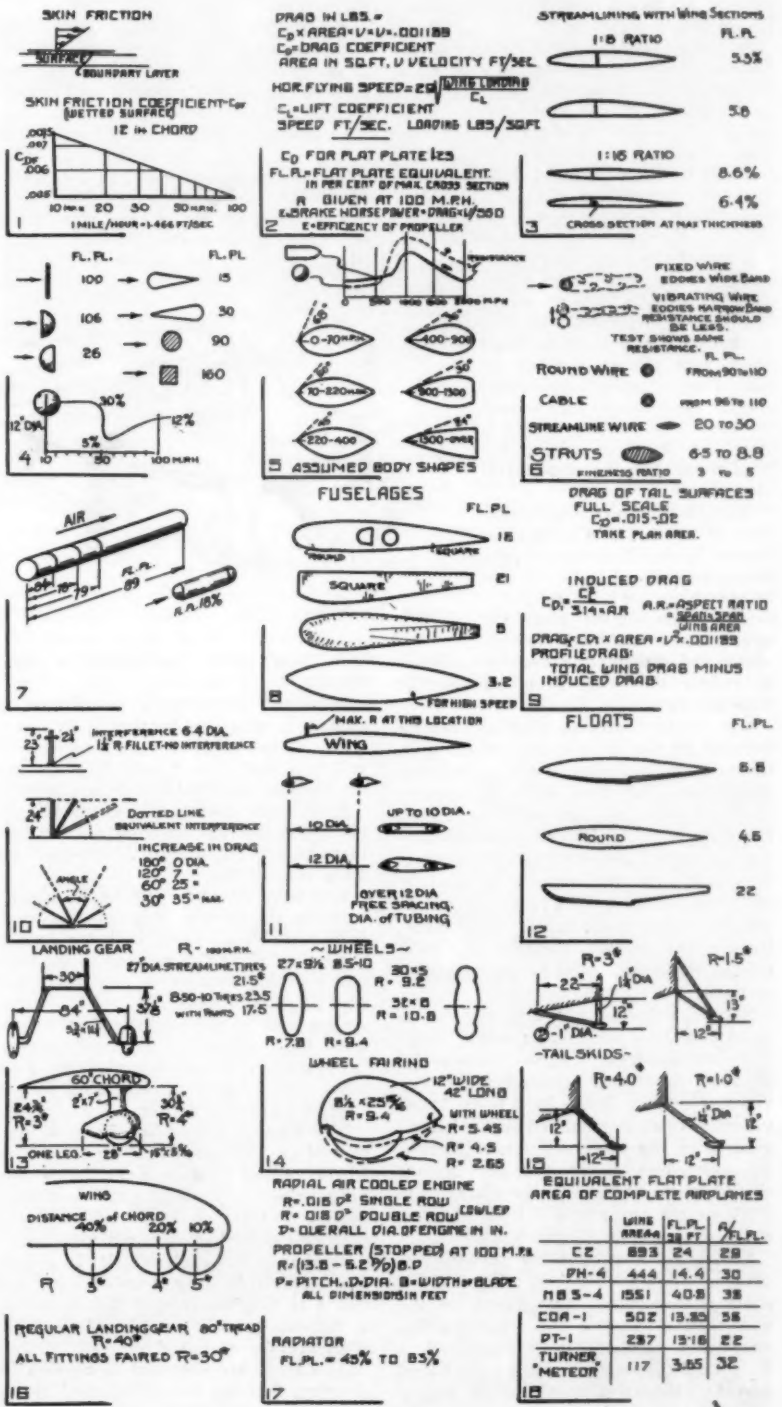
Any drag, for fixed conditions, increases with the square of the speed, and the horsepower required to overcome the drag with the cube of the speed. For example, increasing the speed twice the amount will increase the drag four times and the power eight times.

The reason for the drag is easily understood by investigating an object moving through air. Some air particles will adhere to the surface of the object, the rest will change its position, trying to return to its original place after the object passed. Viewing the whole performance from the moving object, we find that some parts will stay with the object forming the boundary layer. Some of it will pass neatly as laminary flow and some of it will move in eddies as a turbulent flow. This turbulent flow, usually twice the drag of the laminary flow, is the real parasite drag of an airplane.

The shearing effect occurring between the boundary layer and the laminary flow causes skin friction. A diagram in Section 1 shows the change of drag coefficient of skin friction with increasing speed.

For numerical investigations a few formulae are appended in Sections 2 and 9 which may be also used for problems on performances, stability and design of airplanes.

Deducting the drag of the wing, induced and profile, from the total drag of the plane we have the parasite or structural drag. This drag is the sum of the resistances of the fuselage, engine, landing gear and tail surfaces. Erroneously, the tail surfaces are always included in the structural drag, though they are an



integral unit of the wing to make it stable. But we should not alleviate from this common practice that puts the designers of flying wings on the defensive side.

For simplicity and, incidentally for easy memory, the values of the drag are expressed in equivalent flat plate areas; this flat plate or disc area is given in percentage of the maximum cross section vertical to the air stream. Other units have their resistances given in pounds at 100 m.p.h. denoted by the letter R.

Sections 4, 5 and 7 show the equivalent flat plate percentage of various geometric shapes and the variation of the coefficient of a 12-inch sphere with speed. This change of coefficients is the sore spot of aeronautics. Lately, however, some clarification has been brought through comprehension of laminar and turbulent flow.

Section 6 gives flat plate coefficients of wires, cables and struts. It should be mentioned that any kind of fairing of a round strut will reduce the drag by at least 85 percent.

The cause of wires vibrating is sketched in Section 6. Tests show that vibrating wires do not have higher resistance, though theoretically they should be even less, as they leave a narrower band of eddies behind them than the non-vibrating wires.

Section 5 shows the resistance of a round and a fusiform bullet. It also illustrates shapes that are surmised to be efficient at speeds up to 1,300 miles.

The main object after the question of stability, storing space and structure is decided upon, is to reduce the drag, to streamline the exposed parts.

The correct streamlining or fairing depends on the fineness ratio of the unit, the ratio of its length and its maximum thickness. The best ratio at normal speeds is between four and five. Often, however, wing sections are used for fairing. Section 3 indicates using high fineness ratios, the trailing edge should be reversed and using thick sections a standard streamline shape is best. Surprisingly airplane model builders call the streamline airfoil sections "non-lifting" sections.

Special attention is due to the design of fuselages; it seems that some of the oversized fuselages may be the outcome of large-diameter uncowled radial engines. However, it has been proved that the inline or double-banked air-cooled engines give the same resistance if properly cowled as the liquid-cooled engines should give. After all theorizing, the total wetted surface will limit the top speed of an airplane. (Section 8.)

Streamline shapes, wing sections included, will loose all their advantages if some protuberances are placed on the nose section (Section 11). Placing a fine wire around a model at 10 percent of its length will increase its resistance by 60 percent. Mounting an air-cooled engine on a cabin fuselage will increase its resistance by 300 percent, cowling the same engine will reduce it to only 275 percent.

The best design for a windshield on a cabin job has a 55 degree slant. This design increases the resistance of a streamline body by 40 percent. Its flat plate equivalent is 13 percent and its increase at 10 degree pitch is only 1 percent, a negligible factor. A regular fuselage with open cockpit, windshield and pilot has a flat plate equivalent of 20 percent.

Fillets between fuselage and wing should be about half the thickness of the wing, extending past the leading and trailing edges, to eliminate interference or added drag.

Interference is usually present when struts are used. Vertical struts with fillets having a radius of half the width of the strut show no added resistance; but inclining the struts (see Section 10) will give various degrees of interference. Sketches show the interference of 24-inch long struts in equivalent strut lengths.

Minimum interference of tubings in tandem is given in Section 11 in diameters of the original round tubing. It indicates that spaced over 12 diameters the tubings should be kept separated.

Resistance coefficients of floats are similar to fuselage designs (Section 12); they vary from 4.5 to 22 percent flat plate equivalents.

Corrugations and rivet heads greatly increase the profile drag of the wing. Nine rows of rivets on both surfaces of a metal wing add 27 percent to the minimum profile drag. One row alone will add 20 percent drag.

One item of the airplane that creates most of the drag is the landing gear. Consequently, it is retracted on high powered planes, thus increasing its top speed by a great margin.

The landing gear takes 20 to 40 percent of the total structural drag. Sections 13, 14, 15 and 16 show a few interesting drag values of landing gears and their details. Retracting the wheels not more than half their diameters will give higher drag than a low cantilever landing gear. Conventional landing gears—six ft. tread and 3 ft. height—give 40 lbs. resistance at 100 m.p.h., which is reduced to 30 lbs. if all fittings are faired.

Tail skids are sketched in Section 15, showing that the laminated steel spring design has a higher resistance factor than one low cantilever landing gear leg, correctly streamlined.

Radial engines add a certain resistance to the plane. The amount for cowled engines is determined by formulas in Section 17. A single cylinder with its cooling fins exposed has a plate equivalent of 46 percent and if properly cowled the factor is reduced to 15 percent. Propeller slipstream increases the drag of the units lying in its wake. For estimation purposes, 10 to 15 percent should be added to the total structural drag. The drag of a stopped propeller may be calculated using the equation in Section 17. Taking this value to be 100 percent, then, the idling propeller will have a drag of 70 percent, the free-wheeling propeller 44 percent and the feathered propeller 7.5 percent.

Radiators have a flat plate equivalent of 45 percent to 63 percent. It is expected that further tests on carefully faired and submerged radiators above figures will be reduced to about five percent.

In preliminary airplane designs the structural drag is taken in square feet of flat plate area. This area will be independent of the size of the wing to be carried, but the calculation will be more complicated. For rough estimation the ratio of wing area and flat plate area is used. We may call this ratio "efficiency of design." The higher this ratio the cleaner the design of the same category. Some of the values are tabulated in Section 18. The values vary from 20 for braced, light-loaded biplanes to 100 for motorless soarers.

It should be understood that the figures and other data given here are true only up to speeds of 300 to 350 m.p.h., for above these speeds the nature of the airflow changes, and with this change, there is a marked variation in the value of the coefficients. Instead of the resistance increasing as the square of the velocity, it varies more nearly as the 2.5 power of the speed above 300-350 m.p.h.

At speeds approximating 500 m.p.h., the resistance due to turbulence increases tremendously with even a slight increase in speed, so greatly in fact, that modern type power plants are hardly able to cope with the situation.

The flat plate area of a plane, especially of a monoplane, is easily calculated if the brake horsepower, the gross weight, the nominal wing area, the span and top speed are known.

Assuming the propeller efficiency, we find the available thrust in pounds. Deducting the induced and profile drag, the remaining thrust should be equal to the structural drag; then the structural drag will give us the equivalent flat plate area.

The limited number of parasite drag values given should be sufficient for estimating purposes on performances and on stability of an airplane.

END

Sneeze Sleuth

A "HORACE Greeley of pollen," Oren C. Durham, advises, "Fly high, young man, and get away from your hay fever!"

Mr. Durham, chief botanist of the Abbott pharmaceutical laboratories in Chicago, has recently completed and issued a report on a most unusual aerial tour made at the height of the hay fever season. He flew on United Air Line's planes between Chicago, Denver and back again through Omaha, Chicago, Cleveland, and New York, returning to Chicago, exposing during this period 150 vaseline-covered slides from the cockpit window of the big plane at numerous altitudes. By these flights and his microscopic observations, Durham, authority on pollen, discovered many interesting and unusual things.

"The highest number of particles on any slide made in the air was 1,219 and the smallest number was one," he said. "We picked up the big count over a marsh just before landing at Cleveland and the one tiny particle was found at about 9,000 feet near Denver. We did ascertain that pollen practically never gets above 5,000 feet (over terrain) and that within the plane cabin itself practically no particles are ever found, which speaks well for the plane's ventilating system.

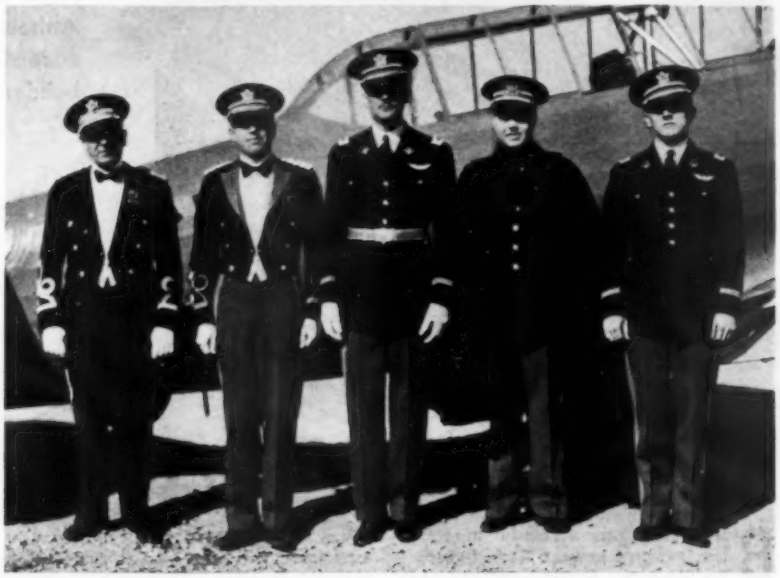
"I planned my flights in conjunction with the airline for the very beginning of the hay fever season and was amazed at the results. We built a special clamp which would hold a slide just outside the cockpit window and we exposed a slide each time for five miles' flight, which meant an average of about two minutes. When a pilot brought me the slide I immediately examined it under the microscope, which in itself is an indication of the smooth flying of the plane.

"The great ragweed belt of the country lies between the Appalachians and the Rockies. The Chicago-Cleveland-Omaha-Sandusky regions are very prolific in ragweed pollen. As we flew west of the Mississippi River we began to pick up more unusual varieties of pollen. For instance, near Denver, we found Russian thistle and sage brush. Over Omaha, the Western water hemp contained considerable traces of marijuana, and we found pigweed, Indian hemp, cockle burr, fire brush and tumble weed. Passing over Pine Bluff, Nebraska, we picked up a little pine pollen, which is about the only one in the area which is non-arritating to the hay fever sufferer's nostrils.

"Flying over the Kankakee River marshes we found considerable hedge pollen and some Russian thistle, and whenever we got fairly low over a wheat field stubble, the perfidious ragweed, which loves to sprout whenever wheat is cut, would send a shower aloft in the up-draft."

END.

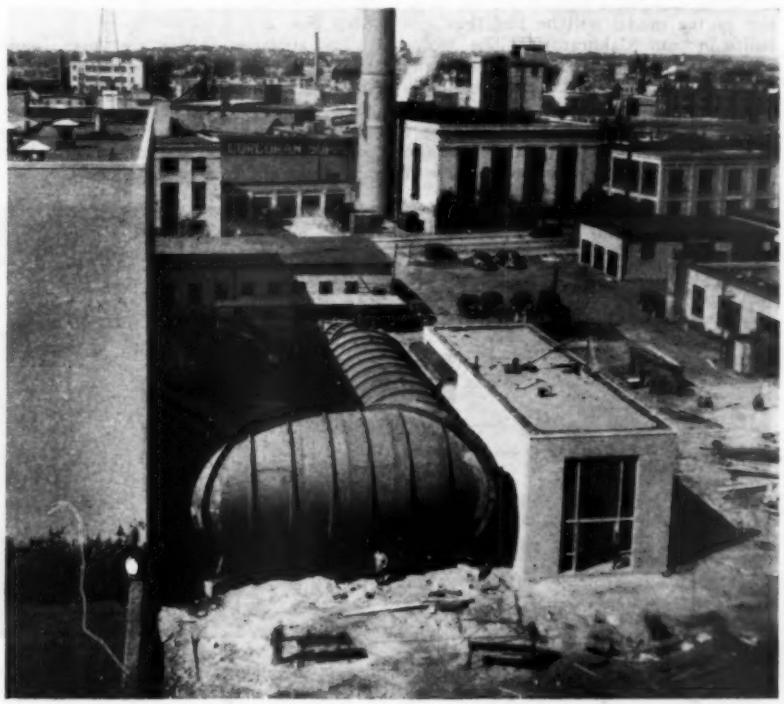
Fawncy, Wot?

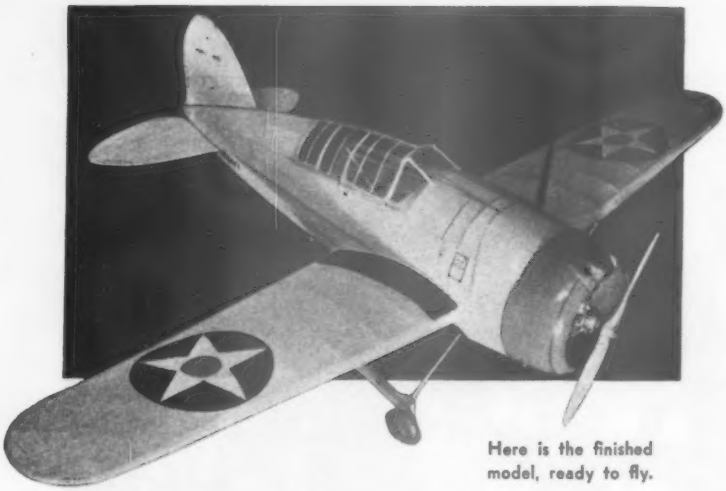


NO self-respecting Army Air Corps officer will go gadding about without one of these five uniforms, Washington, it seems, has gone fashion-wild, judging from the new designs. Anyhow, the new get-ups are dark blue with appropriate gold braid trimming, depending upon who's wearing it. The styles above are, left to right, the social evening dress, mess jacket, full dress, plain dress with cape and plain dress.

M. I. T.'s Wind Tunnel

ORVILLE WRIGHT and a group of prominent aeronautical scientists, formally inaugurated the new Wright Brothers wind tunnel shown below at the Massachusetts Institute of Technology, Boston, recently. The first tunnel of its type to be built in this country, the new tunnel is designed to permit the simulation of substratosphere flying. Wind velocities up to 400 m.p.h. also can be created.





Here is the finished model, ready to fly.

Here is a "scoop" for gas model fans. Although the U. S. Navy only recently accepted the Brewster fighter, model builders already can build it themselves.

by PAUL W. LINDBERG

Model Editor and Designer

★

Build the Brewster F2A-1

BUILDING this authentic model of Uncle Sam's newest Navy fighter—the Brewster F2A-1—will give you many enjoyable hours. Being of a semi mid-wing type, this model has excellent flying qualities. It not only makes an excellent flyer but makes a worthy presentation at any model exhibit. Powered with the tiny ⅛ h. p. *Hornet* motor, it performs very much like the big fellow. In other words this little model has plenty of stuff behind it.

Step No. 1.

Construction: Let us remind you that this model should be given plenty of time in construction as it is far, far too nice a model to rush through with. By enlarging the plans four times, the exact size of the model will be had that was built in our laboratory. The color scheme is: fuselage of gun metal gray with red cowl. Wings and tail surfaces regulation Navy yellow.

The general procedure in building a model is to begin with the fuselage. In this case, however, we will start with the wings so that you may be more accustomed with the work before going into the fuselage. These wings are the full cantilever construction. After all the ribs, spars, etc., have been cut from balsa, they are cemented together upon a flat surface. Sizes of spar and ribs are clearly shown on the plan. Make one left and one right wing panel. It is necessary that all reinforcements shown on plan are placed in their respective positions in the wings in order to gain added strength to prevent any warpping when covered. Spars leading and trailing edges on each wing panel are extended at the root rib in order that they will enter into the fuselage for proper support.

Step No. 2.

Tail surfaces. These are very simple to construct. Use 3/16" square balsa together with 3/16" sheet balsa in their construction. These are of the flat type construction so build them upon any level surface and make sure that all joints are cemented securely.

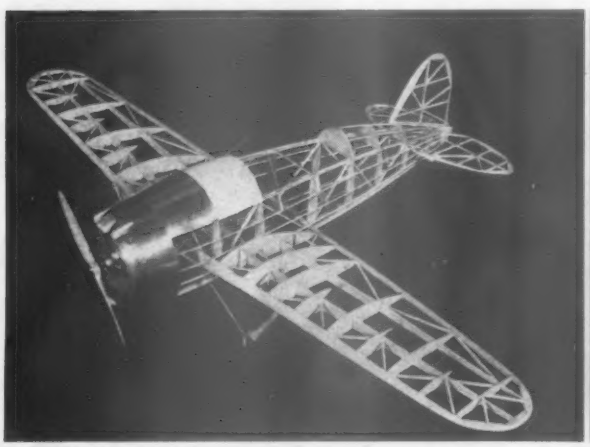
Step No. 3.

Having secured some experience in construction the wings and tail surfaces you now tackle the fuselage. It is comparatively simple if the correct steps are taken. The inner part of fuselage is built up of ⅛" square hard balsa. This is built up into a box-like form. The two sides are first constructed, completeing the box-like frame with the top and bottom cross members. The next step is to cut all the formers from 1/16" sheet balsa. These are now cemented in their proper locations and finished up by sanding off in rough corners where the corners meet. The 1/16" by ⅛" stringers are next attached to the formers. These are placed edgewise on the top of the formers so as to gain the smooth coverning job so desired by all model builders. This method eliminates all possibility of any formers pushing through the covering.

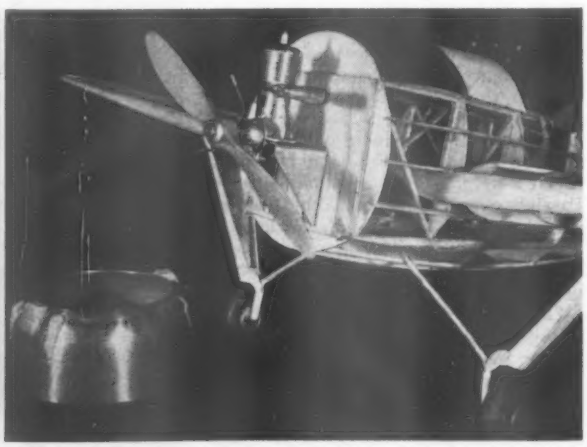
Step No. 4.

The hood which covers the cockpit

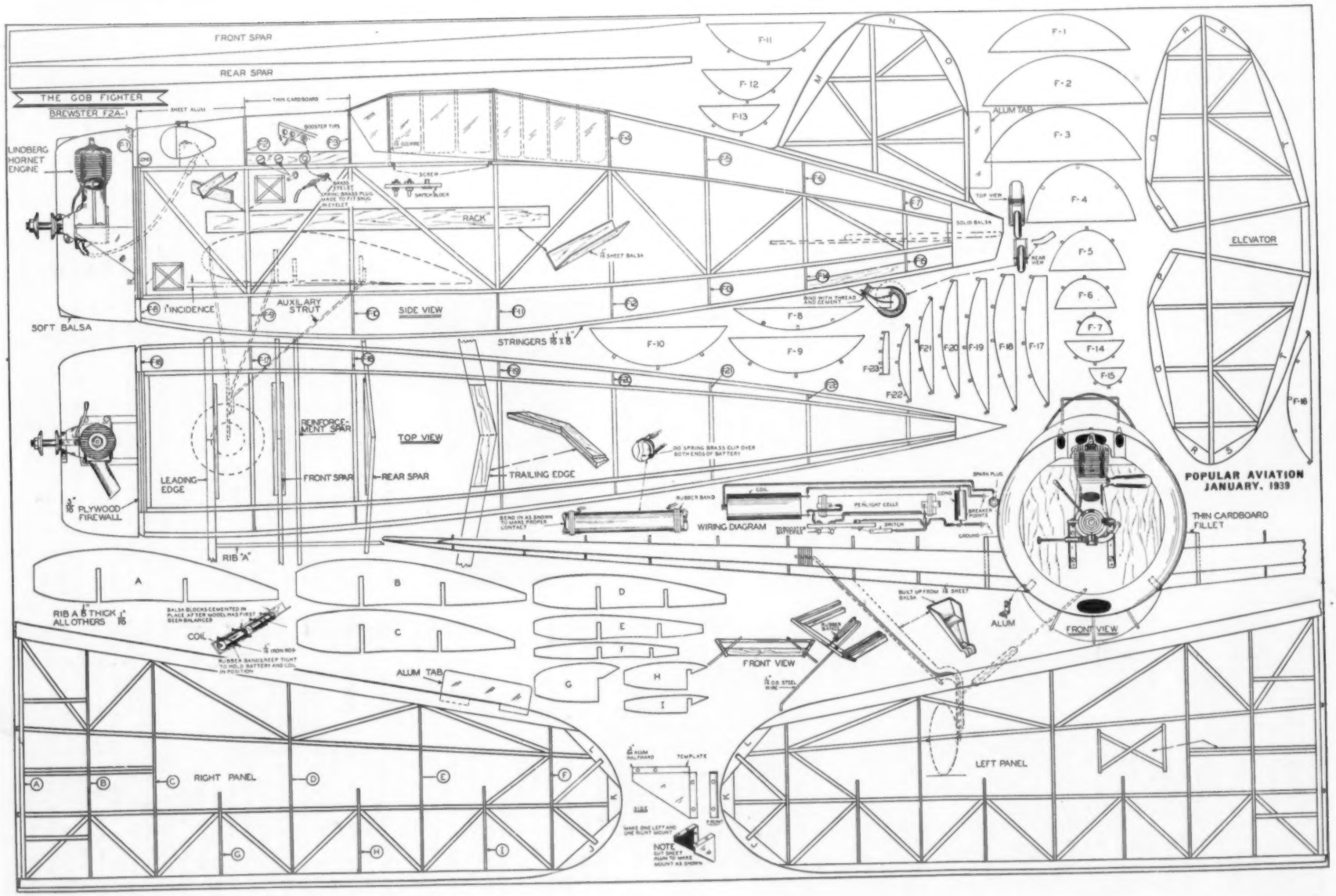
(*Continued on page* 87)



Builders are cautioned to take plenty of time in assembling fuselage and wing. Above is the finished ship before covering.



The Hornet engine lends itself admirably to the Brewster's lines. Note the excellent workmanship Mr. Lindberg has done on the cowl.


THE GOB FIGHTER
BREWSTER F2A-1
FRONT SPAR
REAR SPAR
SHEET ALUM
THIN CARDBOARD
LINDBERG HORNET ENGINE
BOOSTER TIPS
SCREW
SPINNER BLOCK
RACK
SOLID BALSA
TOP VIEW
SOFT BALSA
INCIDENCE
AUXILARY STRUT
SIDE VIEW
STRINGERS 1/8 x 1/8
1/16 SHEET BALSA
REINFORCEMENT SPAR
LEADING EDGE
FRONT SPAR
REAR SPAR
TRAILING EDGE
1/16 PLYWOOD FIREWALL
RIB "A"
RIB A 1/8 THICK ALL OTHERS 1/16
BALSA BLOCKS CEMENTED IN PLACE AFTER MODEL HAS FIRST BEEN BALANCED
COIL
1/8 IRON ROD
RUBBER BANDS KEEP TIGHT TO HOLD BATTERY AND COIL IN POSITION
ALUM TAB
RIGHT PANEL
LEFT PANEL
WIRING DIAGRAM
RUBBER BAND
COIL
PEA LIGHT CELL
CONDENSER
BREAKER POINTS
SWITCH
GROUND
SPARK PLUG
BEND IN AS SHOWN TO MAKE PROPER CONTACT
.010 SPRING BRASS CLIP OVER BOTH ENDS OF BATTERY
BUILT UP FROM 1/16 SHEET BALSA
ALUM
FRONT VIEW
1/8 O.D. STEEL WIRE
ALUM TAB
ALUM HALFHARD
TEMPLATE
RIBS
MAKE ONE LEFT AND ONE RIGHT MOUNT
NOTE CUT SHEET ALUM TO MAKE MOUNT AS SHOWN
F-1
F-2
F-3
F-4
F-5
F-6
F-7
F-8
F-9
F-10
F-11
F-12
F-13
F-14
F-15
F-16
F-17
F-18
F-19
F-20
F-21
F-22
F-23
ELEVATOR
POPULAR AVIATION
JANUARY, 1939
THIN CARDBOARD FILLET

Airy Chat

(*Continued from page 8*)

tions, can be even more dangerous than a wood and fabric structure.

And now we get to the real hazard—the liquid fuel that is necessary for the internal combustion engine. Gasoline is, of course, the most dangerous of the fuels for the reason that it vaporizes very readily at all ordinary temperatures and the vapor is inflammable through a wide range of air and gas proportions. Diesel fuel oil, while not producing the same quantity of vapor, still contains a sufficient percentage of the "light ends" to be dangerous under many conditions of flight. Chemists, here is your real opportunity—to produce a safer liquid fuel than has yet appeared in commercial production!

* * *

SAFETY from the fire hazard is found in solid fuels only, at the present time, fuels such as coal or wood. Solid fuels, however, are practical only with external combustion type engines of which the steam engine is the most prominent example. Semi-solid fuels can also be used in steam engine generators so that the tars, bitumens and similar semi-fluids can be employed without danger. This is one distinct advantage of steam power in planes, but one that will be side-stepped for many years until a shortage of liquid hydrocarbons, and their cost, will make the adaption of steam imperative.

* * *

SOME TIME AGO, a request was made in this column for information on lightning, asking all pilots to report who had experienced trouble with lightning strokes in flight. So far, we have had only one reply to this request, a letter from H. J. Wallis, 385 Ashland Ave., North Detroit, Mich., who writes an interesting letter

He speaks of the wild turbulence of the air in advance of the storm that jumped him up from 1,500 to 6,500 feet, regardless of the controls and then tossed him around like a leaf. Lightning struck the wing twice, running from one tip to the other, but did no damage to the wing or ship. Since that time, Mr. Wallis says that this experience gave him plenty of respect for electrical storms and to give them a wide berth.

* * *

COMPARED with the engine, or other elements of the airplane, the propeller has a surprisingly high efficiency. Properly designed, it usefully transmits over 80 percent of the power supplied to it and this is a high efficiency for any mechanical device.

And, with its high efficiency, it combines simplicity and low-cost of production so that, all in all, it will probably survive for many years to come. Any improvements that will be made, can only add a few percent to the efficiency at the most for the simple reason that the blades are now quite close to 100 percent.

END

Letters

(*Continued from page 62*)

garding the article I have just read in reference to military flight training by General Arnold ("So You Want to Be an Army Pilot?" POPULAR AVIATION, November, 1938).

To begin with my criticism of mass murder, I am not in favor of any form of so-called national defense. As a citizen of the United States I am compelled to pay my share of taxes to further the cause of militarism and all I get out of this squandering of money for expensive airplanes and training young men to kill, is a poor and meager wage. I have no castles that are in danger of being bombed and neither do I own anything in *my* country which needs this elaborate protection that dear Mr. Arnold so vividly describes. I am interested in aviation and flying as a science and what good it can do the common man, but as yet aviation does not cater to me. I can be taxed for these bombers, but I am lucky if I can ever see one . . .

Chicago, Ill. R. L. OLSEN.

Navy Ban

Sirs:

. . . In my estimation the spy scares' most promising growth lay in the many political parties that used them as a part of their platform. Anyone who has ever studied the situation or has been actively engaged in it knows that it is a great and glorious fallacy. My present mania is the fact that the Navy Depart-

ment has censored photos which I obtained at the (Stearman-Hammond) factory . . . of the Stearman-Hammond JH-1 (two of which were ordered by the Navy last year). The fact that these planes have been sold to Holland, all over the United States—and anyone can purchase one—never seem to daunt the Naval officials who consider any material on that plane the direst of military secrets . . .

WILLIAM THOMAS LARKINS.

Oakland, California.

• The photograph of the Navy's JH-1 is *not* Reader Larkins' censored picture. It is just one of many that have been in POPULAR AVIATION's files for at least a year. The "secret" the Navy is trying to keep is that they are using these $7,100 ships as radio-controlled targets for anti-aircraft gunners. One was shot down near San Diego recently.—Ed.

END

Centralized Power?

(*Continued from page 58*)

Beveled gears (Detail "A") could also be employed in various combinations to function as the propeller drive. An alternative is the helical gear drive of Detail "B". The propeller speed reduction could also be effected directly through this arrangement, the attendant reduced tip speed permitting a closer approach to the ideal propeller efficiency with the consequent minimizing of the centrifugal forces acting on the blade elements and the attainment of highly desirable noise reduction characteristics.

For the smaller types of aircraft, belt drives should prove suitably efficient. Recent researches by the Bureau of Air Commerce indicate the feasibility of such drives incorporating the conventional V-belt. By incorporating multiple belts, slippage can readily be maintained at a conservative minimum and the propeller speed reduction effected directly through the selection of suitable size belt pulleys.

In conclusion, it might be said that the case for the inclusion of a plurality of power plants in the larger types of airplanes is based primarily upon the anticipated additional reliability involved in the event of failure of any one unit during flight. Arrayed against this contention are incontrovertible facts which testify that power plant failures, under the cruising power conditions most frequently encountered in normal flight operations, are indeed exceedingly rare occurrences.

Authentic data released by the Federal Bureau of Air Commerce relative to scheduled airline accidents over a given period of time places the item of engine failure near the bottom of the list of probable causes, being preceded by such items as personnel error, unsuitable weather, defective radio equipment and airport and terrain difficulties.

Such failures as do occur, rather than being of a definitely structural nature, are of a secondary form, as, for example, excessive heating of the cylinder heads or of the lubricating oil, neither of which would tend to prevent the power plant from functioning in the event of an emergency provided it could be cut out for a short time and the plane dived to cool the affected members.

Secondly, there is no doubt that the likelihood of power plant failure increases directly with the number of engines employed, since the extensive duplication of accessories and drives subject to mechanical failure during flight must be taken into consideration.

An engineering premise, favorable to the central power plant, may be predicated from the foregoing discussion: "The weight of an airplane of arbitrarily selected size and designed for a given total horsepower output will be a minimum when this airplane is designed with the fewest number of the most powerful available engines."

END

CUB Brings Flying Costs Down-to-Earth!

Now Only $1249

A New 1939 Cabin CUB at a *New Low Price* . . .

Again Cub scores—making it easier than ever for you to enjoy the satisfaction of flying your own plane. At the new low price of $1249 this latest 1939 two-passenger Cub Cabin Trainer J-3 is the sensation of the industry. Powered by the dependable Continental 40 H.P. engine and soundly engineered for economical operation, long life and extra safety, it is destined to win great popularity with private fliers and instructors alike. And its sleek black finish with striking yellow trim makes it stand out in the smartest of company . . . a plane you will be proud to own.

COMPLETE WITH CABIN—Its tight, weatherproof cabin, with deep, comfortable tandem-arranged seats, and its roller bearing wheels are *standard* equipment . . . included in the new low price of $1249. Here, indeed, is aviation's greatest value—made possible by the Cub factory's steady volume production.

ONLY $419 DOWN—You can obtain a new 1939 Cub Cabin Trainer from your Cub dealer for only $419 down—and pay the balance in easy monthly instalments.

OTHER 1939 CUBS—Cub Sport (Continental 40 H.P. engine) $1395; Cub Sport (choice of 50 H.P. engines) from $1499; Cub Coupe (Continental 50 H.P. engine) $1995; Cub Seaplane from $1944; Cub Skiplane from $1299. All prices F.A.F. Lock Haven, Pa.

Free Flying Course

Cub dealers throughout the country are prepared to give every purchaser of a new Cub airplane a course of dual flying instruction in the purchaser's own plane, without charge. This free course is given by Government licensed instructors.

Free Flight Demonstration

Your Cub dealer will be glad to give you a free flight demonstration in a new 1939 Cub. This free flight will reveal to you more emphatically than anything we can say why a third of all civilian airplanes being purchased are Cubs.

Free Catalog!

Send today for colorful, illustrated new 1939 Cub catalog, full details of the free flying course and name of your Cub dealer. Piper Aircraft Corporation, 19 Aviation St., Lock Haven, Pa., U.S.A. . . . Cub Aircraft Co., Ltd., Copenhagen, Denmark and Cub Aircraft Ltd., Hamilton, Canada.

COUNT THE CUBS THE WORLD'S FASTEST SELLING AIRPLANE

Choose Your School Carefully

(*Continued from page* 51)

should be some modern aircraft and engines as well. If the school is a licensed repair station and does practical work on airplanes in service, that is all to the good.

Physical Appearance. If the school is located in dirty- run-down buildings or in hangars that are filled with debris and old airplanes—go slowly. Poor equipment and physical plant often mean poor teaching.

Age. Be careful about a brand new school. It may be all right, but you will not be able to check a number of points suggested here because the school's reputation will not be established. There have been schools that took in the money while it lasted and then closed up. A school that has continued for several years is more likely to have given real service.

Teaching Staff. Good teachers are the life blood of a school. They are more important than equipment. Good teachers, however, will seldom work with poor equipment. It is difficult for an outsider to judge the relative merits of teachers in two schools but this is a point on which former students should be consulted, as well as asking the opinion of aviation officials. A skilled teacher has had a thorough technical training and some practical experience. Both are necessary. He keeps up with the rapidly changing trends of aviation. A good teacher likes to teach and does not engage in such work because he can find nothing better to do. The number of teachers is also important. It is obvious that the instruction will be spread thinner in a class where one teacher instructs 30 or 40 mechanics than if there is one teacher for 15 or 20 students.

Up-to-dateness. Don't choose a school that has not changed its methods in recent years. Methods of doing riveting, welding, heat-treating, and servicing radios, instruments and other parts of the plane are being changed rapidly. A school that does not keep up to date is lost in the procession. Go to a modern school.

Is aviation just a side-line? Select a school whose reputation has been made in aviation subjects. Some schools have made a reputation in other kinds of mechanical work and added an aviation course to get a few more students.

Do the students get jobs? Most students go to an aviation school for just one purpose—to enable them to get a job. If that is your purpose, find out from the school in advance where their former students are now working. Any good school is proud of its placement record and will give you names and addresses of airports, airlines, factories and elsewhere that its students have jobs. Only a poor school will try to evade your questions along this line. Get specific questions, not general ones. Talk to some of the graduates.

Cost. Don't choose a school just because it is cheaper than the others. You can buy a suit of clothes for eight or ten dollars, but most men believe it is poor business to do so. The eight dollar suit is probably worth the money, but most of us believe it is better to wear our old clothes while we save more money, and then buy a good suit. The same is true with aviation training.

A good school needs money with which to operate. Good teachers are worth more money than poor teachers. An engine department must have expensive equipment, as is true with other departments. The more varieties of training a school offers, the more the overhead mounts up.

Flying Schools. The foregoing has been written primarily for students looking for ground jobs. If you are choosing a flying school, many of these principles still hold true. The better schools will have a wider variety of training planes. If you expect to become a commercial pilot eventually, that is worth while.

The most important factor in your learning to fly is to have a good teacher.

PROSPECTIVE aviation students should understand that the aeronautic industry covers a tremendous range of subjects, professions and trades.

Your first step, therefore, is to select that particular branch or specialty which interests you most or which you believe, best fits in with your particular ability or temperaments.

If he is a capable instructor, he will make sure that the airplane is in good shape. Some men have the knack of teaching. If you can find such a man, he will be worth the money you spend whether he is at a large school or at some cross-roads airport. the law of averages, however, is that you are more apt to get efficient instruction from a government approved flying school that makes a business of teaching. This is something to check carefully by asking the opinion of men who are already pilots.

Be skeptical of flying schools that will promise you a job after you have had 25 or 50 hours of flying time. No one is going to put an expensive airplane in your hands and let you crash it. There are too many pilots looking for jobs who have had 500 and 1000 hours for a beginner to get a job.

When you buy flying instruction make sure of how many hours you are getting. If you see a sign at an airport that says, "We teach you to fly for $25," find out how much instruction you get. All flying schools that are certified by the government have met certain standards. You can write the C.A.A. in Washington for such regulations.

How much education should you have before going to a commercial aviation school? Most men in the industry would strongly advise you to finish high school first. Many boys are eager to get to work. They dislike school and want to get out to start earning their own money as quickly as possible. If you feel that way, too, remember that your chances for getting an aviation job, and for advancing to better positions later, will be much improved if you are a high school graduate. This is advice that you would get if you went directly to airport managers or employment directors of airlines or factories.

If you are bored with high school, try to work in as many trade and shop subjects as your school offers. Learn to read blue prints, use lathes, do airbrush painting and learn to use as many tools as you can. But work carefully. Sloppy, careless work will do you no good.

Another reason for finishing high school is that you probably cannot get a job until you are 18 years of age. That is the minimum age also for securing mechanics' certificates from the government.

While we are talking about schools, some of you may ask about college training before getting a final brush-up at a commercial aviation school. It is not possible in one article to discuss fully all the many points about training. But the course to follow is to find out from men in aviation how much general training is necessary for certain kinds of jobs. For airline pilots, meteorologists, engineers and some jobs in the business departments of airlines, men with college training are given preference. Find out if college training is necessary for the job that interests you. Numerous college students these days who want to get into certain kinds of aviation jobs finished college and then spend a year at an aviation school learning their specialty.

If you talk with men in the aviation industry about correspondence school training they will recommend against it. No training or studying will do you any harm. But some boys take a correspondence course and then expect to get a job with no additional training and usually they are disappointed. It is impossible to learn most aviation subjects by home study methods. Save your money and get man-to-man instruction in a practical school.

Don't rush in to any kind of training. Think it over carefully. Weigh the advantages of one school against those of another. You are investing your time, your money and your chances for a job. If you go to a poor school you may kick around from place to place looking for work. If you graduate from one of the best schools, you may not even have to look for work. The school will probably find a job for you. In any case, choose your school carefully and make sure you get your money's worth.

END

The Birdmen's Perch

Two Things-You-Probably-Forgot-To-Remember

1. To send for your *free* copy of the new Gulf Aviation Atlas.

2. That whopper you were going to write about Gulf Aviation Gas. Remember there's a swell specially-illustrated Diploma given every month for the best tall story. Mail your entry to:

MAJOR AL WILLIAMS, alias "Tattered Wing-Tips,"
Mgr. Gulf Aviation Products, Gulf Bldg., Pittsburgh, Pa.

DOUBLE TROUBLE

The other day we met an old friend.

"Here's a problem for you," we said. "Two planes start at the same time from opposite sides of a 10-mile lake and head for each other's starting point. One is aided by a following wind and covers the distance 2½ times as quickly as the other, beating it by 6 minutes. How long did each take?"

"A cinch!" says he, naming both times in about eight seconds flat. "Now *you* tell *me* how fast was the wind?"

Our pal! Take a crack at them puzzles, pards, for old T.W.T.'s sake. And send in your answers before we meet that guy again!

ALL THAT GLITTERS DEPT.

You know how it is with gold. The more it is refined, the better it gets.

Same way with airplane oil. Most highly refined oil is our Gulfpride—the world's finest oil for planes! Gulf's exclusive Alchlor process—used *in addition* to conventional methods—digs down *deeper* into the 100% Pennsylvania . . . removes as much as 20% more engine-fouling dirt and sludge!

AVIATION QUIZ

1. Name 5 American members of the Lafayette Escadrille.
2. Give within 100 the number of airports in operation in the U. S. at the end of 1937.
3. When was the first "stratosphere" flight?
4. Was the first attempt to fly the Atlantic successful?
5. What % of scheduled airline trips were actually started *and* completed in 1937?

Score 20 for each question answered right. Send your answers to T.W.T. for correction.

THIS MONTH'S WHOPPER

Dear Major:

Pinto Bill Colihan's account of his use of Gulf Aviation gas for the curtailment of prairie dogs brings to my mind a similar instance. Being scientifically minded myself, I generally take such stories with a large grain of salt. But his case is an exception inasmuch as it closely resembles mine, which is based on facts presented me by a very reliable friend.

"Techy," my friend, was a district technical-trouble investigator for a large telephone company. Suddenly his district began to be bothered with a large number of telephone replacements, the situation finally becoming so acute he was ordered to investigate.

Like a true technician he went straight to the seat of the trouble and found each one of the telephone units to be mysteriously devoid of that little pile of carbon particles necessary to convert air vibrations into electrical impulses. "Techy" tried to think of something definitely opposed to the presence of carbon deposits and the name "Gulf Aviation Gas" immediately flashed across his quivering brain.

A thorough scrutiny of conditions at the local airport revealed the astounding fact that the local pilot had such a close affinity for his one love, Aviation, that he was accustomed to using gasoline for a *mouth wash!* This habit had been going on for years with ordinary gasolines, but the pilot's recent change to Gulf Aviation Gas caused his breath to raise havoc with the carbon pile in any telephone used by him . . . and he used nearly everyone's!

Technically yours, **Slip Stick Armitage**

Ed. Note: Thanks for the tip! We've taken up gargling G.A.G. ourselves. Now every time the big boss sends us a pencilled memo saying "for heaven's sake, do so and so!," we just blow gently on it and the part we don't like disappears! Some fun! T.W.T.

POETS CORNER

Visibility Unlimited

Most engineers are funny guys.
This streamlined age has made them nuts:
They seldom fly—just work in huts—
And tell the lad who has the guts
A ship's okay before it flies.

Yes—engineers are funny guys—
They make their drawings just as though
A slide rule ought to make them go—
But how they'll run they never know
'Cause engineers are funny guys.

An M.E. once designed a hack,
(The "Everfly" he called his dear).
It took off for the stratosphere—
Now it's been up about a year.
He wonders when it's coming back!

Most engineers are funny guys
They like to boast the bit they know—
There's one or two exceptions, though . . .
My bosses (Ssh, I need the dough!)
Are sterling fellows wondrous wise.

James H. Devlin

Gulf Oil Corporation and Gulf Refining Company . . . makers of

GULF AVIATION PRODUCTS

They've Got to Have Rhythm

(*Continued from page* 13)

right time or the whole rhythmic pattern is destroyed. In such cases, there's no time to figure out what notes to play; it's done subconsciously through hours of practice. The fact that such training sharpens the perceptions is indisputable. When you're handling an airplane, especially in taking-off or landing, it's often necessary to act in a split-second when hesitation would be disastrous.

The subconscious mind plays an important part in learning anything that requires a certain technique or skill to perform. In offering a popular explanation of how the subconscious mind works, many psychologists compare it to a phonograph record, claiming that all impressions, regardless of their significance, are recorded permanently upon it. In other words nothing is ever actually forgotten, though it may be quite impossible to recall it at will. A common experience that seems to support this theory is when you try to remember something that has slipped your mind. It may be right on the tip of your tongue but the harder you try to think of it, the harder it is to remember. But when you stop trying, it will probably flash into your mind without any effort at all. Of course, this phenomenon doesn't enter into the problem of playing or flying for the simple reason that it's too unreliable. However, many repetitions of certain actions and impressions will make a clear and dependable "engraving" on the mental phonograph record. In this respect, there's a great difference between the mental record and the mechanically-made product. Constant playing will eventually wear out the latter type, while the other improves with use.

Maybe you wonder what all this psychological stuff has to do with flying. Well, the point it brings out is that, in order to handle either a *Cub* or a Steinway, you have to practice. And practice builds up confidence. When you're not sure of yourself, you're always wondering if you'll be able to do the right thing. You can't get the thought out of your mind, and the chances are two to one that your fears will be realized. In other words, when you're afraid you'll forget something, you do. Piano practice is an ideal method of cultivating poise and self-control, which is another way of saying that it gives you the confidence to face any situation that calls for quick action, and the ability to make yourself do the right thing without hesitation.

Patience and discipline are two more things that a student flyer and pianist must have in common. A great many piano students make the mistake of beginning to play too soon after they learn the rudiments. While they may be able to read the notes and find them on the keyboard, they're likely to develop faults in technique if they try to play something that's too advanced. Such faults, of course, will be a hindrance to progress unless they're corrected. In the flying game this pitfall is much more serious but, luckily, not so apt to be encountered. A flying instructor's main job is to correct the student's mistakes and no capable instructor is going to give permission to solo until he's thoroughly convinced that the student is able to take care of himself. A music teacher has a similar job, and the piano student quickly discovers that proficiency is *built*, like a pyramid, every new thing learned being based on previous experience.

Unless they guard against it, many amateur pilots fall into the habit of watching the wheels when taking off or landing. The temptation to do this is especially strong when flying a lightplane, on which the landing gear is usually in plain view. At first thought, it might seem that watching the wheels would help one to judge the distance from the ground, but the truth of the matter is that it actually upsets the judgment. When you focus your eyes on the wheels, the ground underneath becomes more or less blurred, just like the background in a photograph when you set the lens for a close-up. This, together with the apparently swift motion of the ground when you look too close under the plane, makes it hard to form an accurate estimate of the distance. In piano playing, there's a similar habit, though not so serious, and that is watching the keyboard. While an occasional glance at the keys may be justifiable whenever long skips occur, it may become a habit that's hard to break even after the keyboard is learned so thoroughly that there's no need for it. The need for avoiding this habit is apparent when one discovers that he can't follow the music accurately when the attention is divided between the keys and the printed notes. And the process of eliminating it will provide valuable training in self-discipline, which will be needed to avoid the corresponding habit in connection with flying.

Undoubtedly, rhythm is one of the basic laws of the universe. One of the characters in a Shakespearean drama says, "There's not a single star that thou beholdest, but in its motion like an angel sings." Using the word "airplane" instead of "star" in this oft-quoted line might spoil the meter but it wouldn't change the meaning. If you want to be a good airplane pilot, a keen sense of rhythm is imperative. The controls have to be handled with a smooth, rhythmic motion, accurately timed. You may have to work them quickly sometimes, as when taking off, but the movements must never be jerky.

A lightplane usually has a comparatively fast period of rotation about its three axes due to the short moment arms and low inertia, while, as a general rule, a big heavy machine is considerably slower in this respect, though it may be just as responsive to the controls. This characteristic, as well as others which may not be the same in any two jobs, affect the handling of the controls, and the pilot must have a good sense of rhythm to adapt their operation to these characteristics if for no other reason. One thing in particular that illustrates this point is a peculiarity sometimes experienced with lightplanes; that is, the ship will start swinging rapidly from side to side during the take-off. If a pilot had a weak sense of rhythm, he'd find it hard to time his rudder movements properly in order to check the oscillations. (In fairness to lightplanes, however, it should be understood that this yawing tendency isn't a common occurrence, and is generally caused by an insufficient fin area.)

Playing any musical instrument requires a good sense of rhythm, but no other develops it to a higher degree than the piano. There's probably no one who completely lacks a feeling for rhythm, for it seems to be a universal trait, even among the most primitive savages. However, it may be less dominant in some persons than in others, but it can be developed through study and practice just as anything else. The value of piano training in this respect is beyond question.

(*Continued on page* 74)

SCHEDULED FLIGHT requires that the Captain have continuous accurate information as to the flight attitude and heading of his plane. The Sperry Directional Gyro and Gyro-Horizon give this information directly, while the Gyropilot automatically applies the accurate calculations of the Captain to the controls of the great air transport.

SPERRY

SPERRY
GYROSCOPE CO. INC
BROOKLYN, NEW YORK

Boeing Graduate DeVer K. Warner, (Class of '36), now with R.C.A. Manufacturing Co., Inc., Aviation Radio Section
Boeing Graduate Mundy I. Peale, (Class of '30), now with Sikorsky Aircraft, Division of United Aircraft Corp.
Boeing Graduate Don P. Wilson, (Class of '32), now Sales Engineer, Fairchild Aviation, Inc.
On their way — thanks to this
CAREER TRAINING

GRADUATIONS AND PLACEMENTS

BOEING SCHOOL RECORD
(October 1937 — September 1938)

Months	Graduates	Placements	No. Co.'s Employing Graduates
1937			
October	4	3	2
November	2	2	2
December	29	7	3
1938			
January	7	14	6
February	1	9	7
March	40	16	6
April	6	13	3
May	6	12	6
June	30	5	4
July	4	8	4
August	2	3	3
September	29	12	10
TOTAL	160	104	28

Boeing School graduates are now making good with major air companies. Because Boeing School gave these men the basic "know how" that's needed to really score in aviation today

WHEN YOU ENROLL with Boeing, you hit the success trail that nearly a thousand graduates of this school, *now employed,* have followed before you. You put yourself in line to get *up* in the industry.

The reason is — Boeing School is operated by United Air Lines, world's most experienced air transport company. United knows the training men require to make good in aviation. *At Boeing School you get precisely this kind of training.*

The very location of Boeing School — directly beside United's biggest Pacific Coast terminus, A-1-A Oakland Airport — puts you close to aviation at work. Here you rub shoulders with all kinds of experienced men . . . experts high in your chosen field.

At Boeing School, classes are small. (Instructors average only 8 students!) You get thorough, man-to-man instruction. If you are serious in your purpose to make aviation your life work, you want Boeing training and Boeing wants you.

• • •

Send immediately for latest BOEING SCHOOL BULLETIN. It describes fully the career courses offered; gives valuable vocational guide to all fields of aviation. *Don't put off this important first step! Use Opportunity Coupon below.*

Boeing School of Aeronautics

A division of UNITED AIR LINES

U. S. Government approved in ALL departments—Private and Commercial Flying, Mechanic Training, and Repair Station

A COMPLETE RANGE OF CAREER COURSES

There's one specially designed to provide a thorough foundation for success in *your* chosen field of aviation

Check the course or courses you're most interested in:

Courses requiring High School only:

- ☐ Airline Pilot and Engineering
- ☐ Airline Operations and Engineering
- ☐ Airline Mechanic and Operations
- ☐ Commercial Pilot and Operations
- ☐ Airline Mechanic
- ☐ Private *(or)* Solo Pilot
- ☐ Limited Commercial Pilot
- ☐ Aircraft Sheet Metal

Course requiring 2 yrs. of College

- ☐ Air Transport Engineering

Courses for engineering graduates only:

- ☐ Airline Technician
- ☐ Airline Meteorology

Course requiring special training:

- ☐ Special Airline Pilot

NOTE: Link Trainer and modern multi-motor instruction available to students in all courses.

Boeing School of Aeronautics,
Dept. Q-36, Airport,
Oakland, California.

SEND THIS COUPON NOW!

GENTLEMEN: Please mail me—without charge—the BOEING SCHOOL BULLETIN containing complete information on the school and courses I have checked at the left.

Name _____

Address _____

City _____

State _____ *Age* _____

They've Got to Have Rhythm

(*Continued from page 72*)

Co-ordination is one of the most important things in flying, and one of the hardest to learn. Not only does the mind and body have to work together, but the controls must be operated in perfect synchronization with each other. Playing the piano is an excellent means for developing co-ordination, for it trains you to do several things at once and in harmony. When you play a musical composition, your hands and even fingers—also your feet when operating the pedals—must work independently of each other, yet they must work together in producing the desired melodic and ryhthmic pattern at the same time. In fact, the problem is more complicated than in the case of handling an airplane. And of course, mastery of the more difficult problem—which isn't beyond the ability of any normal person who progresses in easy stages—will simplify the corresponding problems of flying.

This just about sums up all the advantages of musical training from an aeronautical viewpoint as far as direct application is concerned, but in a number of other ways, it will be of indirect value to a flying student. For example, accuracy, precision and attention to detail are among the factors that determine a good pilot. In the study of music, the slightest detail is important. Though it may be a tiny dot no larger than a period it has a definite significance, and the whole works would be upset if it were overlooked. With such training one learns the importance of little things, and isn't likely to meet with a flying accident through carelessness or inattention.

Airplane pilots, being subject to the laws of human nature the same as anyone else, aren't immune to occasional irregularities in emotional stability and temperament that come as a result of mental strain. A hobby that provides relaxation is one of the best ways to avoid these moods and maintain emotional balance. No other hobby will meet these requirements so effectively as music. Any pianist will tell you that playing is a positive cure for the "jitters." Tests conducted by mental specialists have given definite proof of the powerful influence that music has in relieving nervous tension and monotony. In more than one instance, it has actually cured mental disorders.

Unlike the old days, it's no longer practical to break into the flying game via the apprentice route. If you lack the financial means for a formal course in dual instruction at a recognized aviation school or from a qualified private instructor, the only solution is to wait until you accumulate the necessary funds. In the meantime, you can be preparing yourself by studying any of the good aeronautical text-books on the market and reading the aviation magazines. But above all, you can study the piano at little or no expense and in doing this you'll actually be acquiring the mental and physical powers that an airman must have to fly a ship—something that can't be learned from books.

Flying an airplane and playing a musical instrument are two things that can't be taught; they have to be learned by study and practice. While a flying instructor is practically indispensable, a music teacher isn't essential. Anyone with determination and normal intelligence can learn to play the piano without a teacher by following any of the clear instruction books now available. And thanks to modern methods of instruction, long hours of tiresome practice aren't necessary, and in a surprisingly short time, one can begin to play fairly well.

The success of the wartime musician pilots was notable for a number of aces ranked as orchestral soloists.

Many authorities believe that, with one or two possible exceptions, anyone who has the physical and mental qualifications for learning to play the piano will have no trouble in learning to fly.

END

The German Air Farce

(*Continued from page 12*)

viewed several ways. It may be wise to let Germany believe Britain thinks she has a great air force. It may be good propaganda, forestalling events until they are ready. Here in this country it is good news copy, building up the German threat and justifying all the war-scare headlines of late September. The British may use it to justify their stand on the Czechoslovakian situation and to cover the fact that they actually had no material interest in what happened to Czechoslovakia. To return here again, these phoney figures on the power (?) of the German Air Force can always be used to build up another angle of the demand for a greater national defense here. And we trust that it will leave this reaction.

All the threat of the German Air Force bombing London or Paris is just so much hoopla. True they could send a limited fleet across the North Sea and attempt to bomb the British, but most certainly the British would not be playing cricket while all this was going on. They might be having a game, too, by going to Germany and dropping the old pudding on Pottsdam—and what a squawk that would set up.

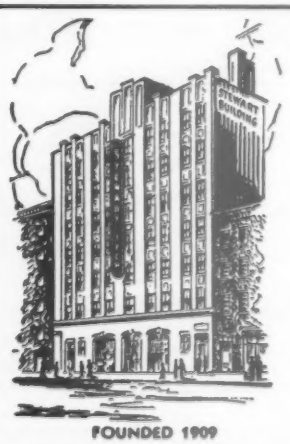
Why not look at the picture from the other side? What about the British shoving a few of her aircraft carriers up into the North Sea, and releasing a few bomb-carriers to play hop-scotch over Hamburg, Kiel and Bremen?

No, we can't swallow all this German Air Force bunk, because we have to look at it sensibly and forget the propaganda blah. Let them show us one reasonable bit of data, evidence of all these bomber squadrons, and stop filling the papers with formations of 90 h.p. Klemms in country fair formations and we'll be reasonable and listen.

Nine thousand fighting planes, eh?

If the truth be known, France, Britain and the United States together couldn't put that many into the sky at once.

END



FOUNDED 1909

AVIATION TRAINING

at STEWART TECH

Enroll now at Stewart Tech and qualify yourself for an important position. You are taught the theory and learn by doing practical work in the following courses.

Aircraft Mechanics — Aircraft Sheet Metal
Aircraft & Diesel Engines — Aircraft Radio
Aeronautical Drafting and Design

The Stewart system of training is backed by 29 years' experience. Graduates are eligible to make application and take the tests required for Government licenses. Tuition payments may be arranged on a weekly or monthly basis. Descriptive Catalog free. Call or write the

AVIATION DIVISION

STEWART TECHNICAL SCHOOL

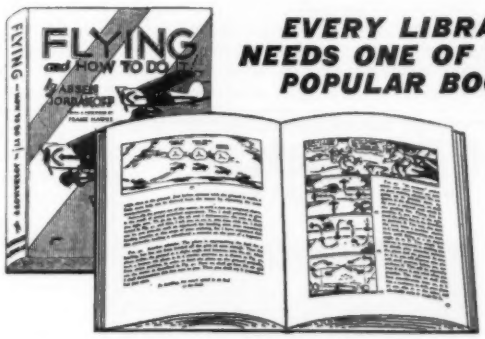
Dept. 121 Stewart Tech Building, 253-5-7 West 64th St., N. Y. C.

Licensed by the State of New York. Approved by BUREAU OF AIR COMMERCE as an AIRPLANE AND ENGINE MECHANIC'S SCHOOL

ZIFF-DAVIS PUBLISHING COMPANY
(PUBLISHERS OF POPULAR AVIATION)
OFFERS THESE AUTHORITATIVE

BOOKS ON AVIATION

Here's your chance to have aviation's knowledge at your fingertips. Give your library wings. Practical, informative books on the fundamentals and fine points of flying—technical facts—aerial navigation—entertaining fiction.



EVERY LIBRARY NEEDS ONE OF THESE POPULAR BOOKS

AIRPLANE SERVICING MANUAL (501)
By Victor W. Page
Lieut.-Colonel, U. S. Air Reserve $6.00

As a result of specialized and exhaustive research, practical information never before published is included in this book. Written in simple language for the practical man by an experienced instructor and flying field engineer. This is an invaluable book for reference and study. Outlines machinery, shop layout, hangar equipment, tools, supplies and mechanical processes incidental to welding, heat treatment and manipulations of all important materials of construction including wood and fabric, with special instructions for metal airplanes and modern applications of duraluminum, Alclad and stainless steel. 1000 pp., 6x9.

FLYING AND HOW TO DO IT (502)
By Assen Jordanoff
Foreword by Frank Hawks $1.25

"Flying and How to Do It" is a brand new idea, conceived and executed by a well known flyer and designed to satisfy the demands of thousands of young men and women who are waiting for a chance to try their wings in the air. For those who wish to learn the facts of flying step by step, and wish to start with basic information and have the principle of flying explained.

AERIAL NAVIGATION AND METEOROLOGY (503)
By Capt. Lewis A. Yancey $4.00

A comprehensive treatise written in simple language for the student with an average education. Contains numerous solved problems and examples for practice. The writer is recognized as an authority on aerial navigation and meteorology and has been retained as advisor to several of the more important long distance flights in recent months. This book contains the practical information that the student and pilot need.

OTHER GOOD BUYS FOR YOUR LIBRARY

I WANTED WINGS (504)
By Beirne Lay, Jr. $2.50

If you want to feel the impact of speed, danger, terror—read Beirne Lay's personal narrative. His story of the making of an aviator gives the reader the sum total of a pilot's experience. It carries you along from excitement to excitement:—lifts you for wild rides on fifteen-thousand-foot hills of snowy clouds—sends you overside in a parachute to be plunked into the cold waves of a wintry ocean—dumps you head-down in the mud in a hedge-hopping crash—drives you scrambling from the wreck of a bomber lest you be burned to death.

ONCE TO EVERY PILOT (505)
By Capt. Frank Hawks $1.50

Contains 144 pp. in which such great aviators as Eddie Allen, Jimmie Mattern, Wiley Post, Eddie Rickenbacker, Al Williams, Capt. Frank Hawks himself and others tell you in their own words how they felt when they encountered danger and flirted with death. Easy to read and will provide entertainment for the entire family.

WAR BIRDS (506)
Anonymous 98c

The thrilling story of war in the air revealed in the diary of an unknown aviator. Illustrated.

TEST PILOT (507)
By Jimmy Collins 59c

Exciting pages from the life of one of America's greatest airplane test pilots who lost his life while doing his job.

WHAT ABOUT THE AIRSHIP? (508)
By Commander C. E. Rosendahl, U. S. Navy $3.50

The case for the airship, its wartime and commercial record and its possibilities for the United States, presented by one of the world's foremost authorities, who gives his own startling theory of the cause of the Hindenburg disaster.

THIS FLYING GAME (509)
By Brigadier-General H. H. Arnold & Major Ira C. Eaker $3.00

What every one wants to know about flying—as a vocation, as a hobby, as a commercial factor or as a military weapon—written in a popular style by authorities. Answers the questions—How can I get into aviation?—What sort of examinations, physical and mental, need I pass?—What is the life of a flyer like?—What prospects of a job are there for the flyer who has acquired his training? With 149 Photographic Reproductions. Cloth, 294 pp., illustrated.

Our book lists also present a wide variety on Photography, Radio, Science

IMPORTANT!

Use this coupon to secure any of the books listed above, or to secure information and prices on any other reference books not listed. Check the items you want and mail in today.

CHECK YOUR CHOICE ON THIS COUPON

Ziff-Davis Publishing Company, Book Department
608 S. Dearborn St., Chicago, Illinois

Gentlemen: Please send me the books whose numbers I have encircled below.
Book No. 501, 502, 503, 504, 505, 506, 507, 508, 509

☐ Price Enclosed $..... ☐ C. O. D. (Plus Postage)

Name.....

Address.....

City..... State.....

Remember the 'Bullet'?

(*Continued from page 33*)

aeronautical world. The *Bullet* was not the first low-winged, super-clean airplane. But it carried the basic idea of utter refinement to a point further than that of any contemporary plane, and the Alexander company was the first to broadcast that basic idea to the flying world.

Drive out to any large airport today and you will see the not-yet-overgrown offspring of the *Bullet*, which was the modern airliner, in miniature. Its fuselage rode above the wings for several reasons, the chief of which were self-evident to any analytical layman. With a high-wing plane (where the wing is attached at or near the top of the fuselage) the fuselage must be built strong enough to carry the weight of the wings and withstand the shock of their momentum when the plane touches earth. With the *Bullet*, as with all modern low-wing ships of its size, the fuselage served chiefly as a canopy and engine mount. As such, it could be built more lightly than could the fuselage of the high-wing type. And your aeronautical engineer loses sleep figuring how to shave the weight of each new design. Passengers can draw comfort from the fact that they are riding above a staunch, solid piece of bridgework in a *Bullet*-type ship. Then, too, there are no heavy structural members overhead. Moreover, the fact that the fuselage was above the wing made it possible to retract the landing gear partly into the wings while the ship was in flight, and thus eliminate its "dragging anchor" effect. Modern airliners use the same thing.

Let us repeat. The *Bullet* was a "first" only in that it incorporated a lot of "firsts" which had mainly been proved earlier. For years, before its advent, the Germans made successful use of the low-wing design. Several American factories were turning them out for private sale. Nonetheless, the *Bullet* was the first low-wing light ship produced in America—and perhaps in any other country—which took full advantage of the low wing to present as "clean" a design as the aeronautical ingenuity of the time could put on paper.

The *Bullet*—in its final form—was a materialization of aerodynamic dreams. Carrying four people and a dog, it presented the least possible interference with the impact of the air of any ship of the day. All parts possible, including the door handles, were removed from the air flow. The wing was full cantilever. That is, it was braced internally, so as to eliminate struts, flying wires and other such impedimenta.

Like most other engineers, Mooney realized that the airplanes of the late Twenties were growing more dangerous as they gained speed. That was because the landing speed increased every time a designer sacrificed wing area and added more horsepower to gain top speed. To a large extent, the low-wing design modified this trend, and the evolution of "air brakes" has since carried it farther.

Given the same amount of weight, wing surface and top speed, a low-wing plane will land at a considerably lower speed than will its high-wing mate. It does so because the lower the wing to the ground, the greater the cushioning effect of the air, which in any landing, is slightly compressed between the wing and the ground. However, let's not get too technical. We may start an argument.

Before a plane may be used for commercial purposes in this country, its design must receive official "benediction" in the form of an "Approved Type Certificate." ATC's are issued by the Civil Aeronautics Authority—but only after a painstaking "candling of every egg" in the plane. Once the original passes muster, every exact duplicate is entitled to carry a "C" license of approval.

The *Bullet* rode to glory with an "X" (experimental) license. Before and after it managed to win a "C", a number of things combined to toss it into oblivion. Not one was ever sold.

At the 1929 air races in Cleveland, a 165 h.p. *Bullet* made monkeys of ships of almost twice the horsepower in the 1,000 mile, triangular, cross-country efficiency race. At the hands of the veteran Errett Williams (later killed in a Texas fog) the ship won more prize money than did any other single contender. In a half-dozen other important air rodeos of the year it never lost one of these efficiency events—and it demonstrated a speed that was far ahead of any stock model of its class. In an efficiency event, victory depends upon a combination of speed and carrying capacity per horsepower. The *Bullet* flew slightly faster than 165 m.p.h. with a 165-h.p. motor.

For four years the private airplane market had snow-balled on the premise

THE WORLD'S FINEST MODEL AIRCRAFT

SEVERSKY P35 PURSUIT

32" Span. Length 23". 1" Scale
Const. set, complete with set of colored paints, full size plans, etc. Postpaid..... $3.25

BOEING B17 FLYING FORTRESS

44" Span. Length 30". Weight 6 oz.
Const. set with set of paints and all parts to build. Postpaid..... $5.50

CURTISS F11C4 PURSUIT

Span 32½". Set $4.50 P. P.

BOEING F4B4

Span 22½". Set $2.95 P. P.

LOCKHEED P23A Land and Seaplane Set

Span 32". Set $2.95 P. P.

CURTISS HAWK 75

Span 37". Set $3.25 P. P.

NORTHROP A17

Span 24". Set $2.50 P. P.

LOCKHEED SPEED VEGA

Span 30". Set $2.95 P. P.

These sets have all parts printed on balsa, set of colored paints, glue, carved props, and all parts to build as shown. Curtiss F11C4 and Boeing F4B4 have celluloid motors and aluminum cowls. SEND 10c COIN for NEW 20-page Illustrated Catalog.

MINIATURE AIRCRAFT CORP., 83 Low Terrace, Staten Island, N. Y.

AERONAUTICAL ENGINEERING

DEGREE IN 2 YEARS

BECOME an Aeronautical Engineer. Tri-State College course given in 108 Weeks. Bachelor of Science degree. Graduates in Mechanical Engineering can complete aeronautical course in 2 terms (24 weeks). Thorough training in all fundamental engineering subjects. Equipped with wind-tunnel (see illustration). Non-essentials eliminated. Courses designed to save student time and money. Flying school facilities available at nearby airports. Properly trained engineers in design, research, manufacture and sales work are in demand. Enter September, January, March, June. Courses are offered also in Civil, Electrical, Mechanical, Chemical, Radio Engineering; Business Administration and Accounting. Living costs and tuition low. Those who lack high school may make up work. World famous for technical 2-year courses. Graduates successful. Write for catalog.

719 College Ave. Angola, Ind.

55TH YEAR

TRI-STATE COLLEGE

that almost any buyer could pay for a plane quickly by hopping passengers and training more flyers. The bubble popped, as it always does, when the process was carried to the point of over-expansion. The private airplane market collapsed in the summer of 1929. The private plane has since made a rousing comeback.

But, it was not the "crash" that knocked the *Bullet* into a cocked-hat, commercially. It was something known as a "spin-test." Our Air Commerce Bureau (now the Civil Aeronautics Authority) demands that a new model plane demonstrate an ability to recover from a spin in not more than one and one-half complete turns after it has been made to spin six turns with the ship fully loaded.

Now it is one of these well-founded axioms among old pilots that a ship that goes into a tailspin easily may be brought out of that spin with equal ease. And vice-versa. The *Bullet* was a tough customer. It refused, at first, to spin. The factory test pilots—all seasoned flyers—found it impossible to do the trick in a normal manner. Ordinarily an airplane, when throttled back, pulled up into a nose-high stall and kicked over by the rudder, will promptly go into its dance. But the *Bullet* did not behave, or rather, it behaved too well. When the pilots tried the orthodox ways of doing such things the ship fell off into a wide spiral and was under full control all the time. In a true tailspin a ship is completely stalled and out of control until matters are corrected. Recovery in a licensed ship should be a simple matter.

Nothing is certain about a new-model plane until it has been in active service for a period. Knowing this, the factory entered the ship in a dozen aerial rodeos, then called in a crack test pilot.

The first victim was Errett Williams. He hailed from South Carolina and was vitality personified. Two hundred years ago he would have captained a free-booting privateer. In 1929 he was widely known among the Quiet Birdmen as a "natural" flyer whose ability had improved after a sound war-tempering. Williams had won $15,000 in prize money at the Cleveland races. He knew and loved the *Bullet*.

Ten thousand people ringed the Alexander airport the day Errett Williams climbed the *Bullet* almost out of sight. Among them were those who would have flocked as readily to a good bull-fight, and they were not disappointed. When Williams reached 7,000 feet his ship looped up and over on its back, slid off into a tight, normal, nose-down spin. It made five, ten, 15 lightning revolutions. The airport gang shifted its feet. "Something's screwy" said the initiated. At 3,000 feet, the ship was plainly in one of those pilot's nightmares—a flat spin. At 2,000 feet a white pinpoint appeared below the ship.

Errett stayed with the ship as long as he could. He tried everything in the book until his senses swam. It was sheer animal instinct that forced him through the overhead escape window and out into emptiness. At that—so sub-conscious were his actions that he went off the inside wing of the ship—something that is never done. As a result the ship almost spun into him. A flashing wing-tip ripped eight panels of his parachute and he began dropping about 25 feet a second instead of the normal 16. He escaped with a sprained back and enough loss of memory to have a hard time repiecing his experience.

The *Bullet* was not nearly as damaged as its pilot. It had executed the flattest of tailspins. And I might explain here, for the benefit of non-flyers, that a flat spin differs from a normal spin in that the plan rotates almost exclusively on a vertical axis and the nose and tail stay level with the horizon. Most flat spins are uncontrollable because it is impossible for the pilot to get the nose down and pick up enough air speed to recover from the stalled condition.

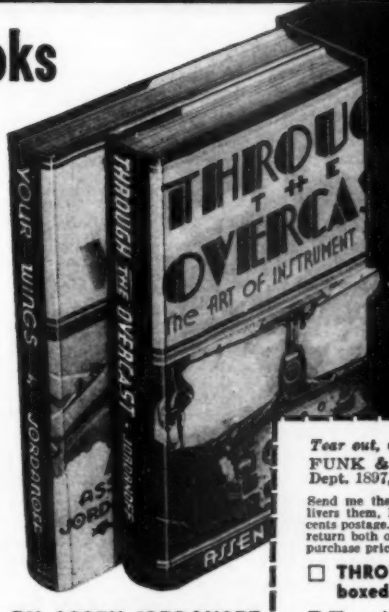
The *Bullet* had spun so flatly and so rapidly that it lost little altitude with each turn. After looking over the wreck, the airport gang agreed that Williams might have suffered little or no injury had he stayed with the ship.

That opinion, however, may have cost the life of Bill Sylvester two weeks later. Bill was a tall, raw-boned and easy going individual from South Dakota. He could have filled the role of an old plainsman in any Western movie. He heard the factory would pay $250 for a test-spin of the next *Bullet*. It rolled off the line within two weeks. Bill de-

The Standard Books on Flying the World Over

These are the books the airmen use

—to make themselves better, safer fliers . . .



THROUGH THE OVERCAST
The Art of Instrument Flying

C. R. Smith, President of *American Airlines, Inc.*, says: "This book has taken the subject of meteorology out of the mathematical equations and has made it simple enough so that the average person can understand it. In addition, the author has explained instruments, as well as radio and all allied subjects, through a series of pictures, so thoroughly that it will help not only the professional airmen, but the fledglings as well to grow bigger and faster wings."

Over 300 illustrations make everything crystal clear in this book. It gives in words and pictures accurate descriptions of the function and use of the new instruments now being installed in planes to make flying easier and *safer*.

YOUR WINGS
The Manual of Flight

A FAMOUS book on the art of modern flying, which has, in less than two years, been translated into 7 languages, and been bought and used by tens of thousands of aviators the world over. Standard text in leading aviation schools throughout America. *Over 400 illustrations.*

BY ASSEN JORDANOFF

Pilot, instructor, engineer, technician and technical adviser to leading American airlines and manufacturers since 1921.

SEND NO MONEY

Either **Through The Overcast ($3.00)** or **Your Wings ($2.50)** are available singly from any bookseller, Air Associates, Inc., or from the publishers. See coupon at right for special no-risk, trial offer.

A LAVISHLY ILLUSTRATED COMPLETE AVIATION LIBRARY IN 2 VOLUMES

Endorsed by leading figures in the aviation industry; hailed with delight by men who pilot, build, maintain, or dispatch airplanes. There are **over 700 illustrations** in these two books, to help you know flying from the ground up—from basic principles through the newest technical developments in instrument flying. Both text and pictures are the work of experts.

TOGETHER, BOXED, ONLY

$5.00 *You pay nothing if not satisfied.*

Tear out, sign and mail to
FUNK & WAGNALLS COMPANY
Dept. 1897, 354 Fourth Ave., New York, N. Y.

Send me the books I have checked below. When the postman delivers them, I will deposit with him the price indicated, plus a few cents postage. I understand that if I am in any way dissatisfied, I may return both or either of these books within 10 days for full refund of purchase price.

☐ **THROUGH THE OVERCAST and YOUR WINGS, boxed, $5.00.**

☐ Through the Overcast, $3.00. ☐ Your Wings, $2.50.

Name.....

Address.....

City & State.....

NOTE: Check here ☐ if you enclose remittance with order, in which case books will be mailed post free. Same return privilege applies.

AERONAUTICAL UNIVERSITY

(Founded by Curtiss-Wright)

Government Approved — State Accredited

Our graduates are with all leading aviation companies and air lines.

Courses in

AERONAUTICAL ENGINEERING
Mathematics, Drafting, Airplane Design, Stress Analysis, Wind Tunnel, etc.; thirty subjects.

LICENSED MECHANICS
Prepare for Government licenses: Airplane, Engines and Radio. Includes Sheet Metal, Welding, Drafting, Aircraft Construction, Engines, Inspection and Maintenance.

ADMINISTRATION
Transport, Traffic, Sales, Aviation-Advertising, Aerial Photography, Airport Accounting, Navigation, Meteorology, Airplanes, Engines, Radio for U. S. Government License.

Outstanding faculty. Up-to-date equipment. Reasonable tuition. Easy terms. **DAY AND EVENING SESSIONS.**

Write for Free Illustrated Bulletin

AU ACCREDITED

Address
AERONAUTICAL UNIVERSITY
CURTISS-WRIGHT BLDG.
Dept. P. A.
1338 S. Michigan Blvd.
Chicago, Illinois

MIDGET RACING
Get full details on this thrilling sport; facts for fans, builders and drivers; track sizes and regulations; car specifications, pictures and working drawings. This book also shows and tells about Indianapolis cars, Miller-Fords and world's fast cars. AUTOMOBILE RACING, Fourth Edition, $1.00 postpaid, $1.15 C.O.D.
RAY F. KUNS.
Dept. E-25, Madisonville, Cincinnati, Ohio

FAREWELL TO THE TIN GOOSE

At long last, a belated tribute to that airplane of airplanes, the trimotored Ford. Henry Ford gave the world its most romantic auto in the Model T—and played the same role in aviation. The author is John Collings, former Ford test pilot.

"I WAS BOMBED"

- - - - - by *FRANK TINKER, Jr.*

The author, who wrote his flying experiences in the Spanish war for this magazine, had the tables turned on him.

FEBRUARY ISSUE

POPULAR AVIATION

ON SALE JAN. 10th

cided that his family could use the money.

That day the same crowd formed, with reinforcements. Then streamed across the prairies to the spot five miles away where Bill lay in his wrecked ship, his neck broken. In the opinion of the airport gang—he had chosen to ride it down rather than take to his parachute. He, too, had been caught in that spasm of aerodynamic indigestion that is a flat spin.

J. Don Alexander, the head of the works, was a business chief of the old school. Two hundred dealers—fired by advance publicity—were clamoring for the *Bullet*. He determined to "fight it out on this front if it takes all summer" —and fall. It did.

James S. "Shelly" Charles, a cavalier of old Virginia, next enters the ring. Shelly knew that he stood to earn the $500 which he accepted to become the third novitiate. He took appropriate measures. En route to Colorado Springs, he devoted days to conditioning his subconscious mind. (For, he knew, the conscious mind is not to be trusted in an acute flat spin.) Therefore, for hours he mentally rehearsed the routine necessary to abandon ship. Meanwhile the factory had made a desperate effort to lick a problem that probably would have baffled any engineering staff of the time. Another test model was dollied over the railroad tracks to the field.

Up to the minute of his take-off and while he piled some altitude below him, Charles continued his mental calisthenics. At 7,000 feet he was up and over on his back. Once more, a few tight normal spins, and, again, the whirling pancake. After fighting it for a few minutes he felt the fatal black-out coming and he did one of the cleanest jobs of emergency jumping in the history of flying. Later, he also confessed that he could remember little more than dangling in the chute straps and wondering how he had escaped the swirling dervish.

At this stage the Alexander company began advertising for professional test pilots. One Pat Love of Indiana saw the ad, and answered it. Pat was a pilot who had cured several sun-fishing airplanes. To him, flat spins were all in the day's work. Another altered airplane left the assembly line—and the airport gang regarded the newcomer with as much awe as can be found around a flying field. Love arrived on Sunday. He looked the ship over and declared that he liked what he saw. On Monday he took it aloft under instructions to "feel it out." It handled so beautifully—that he made an understandable mistake. He hauled it over on its back and pressed rudder. Ten normal turns and the nose began to rise.

Love started his spin at 4,000 feet. Within ten seconds a wave of nausea engulfed his senses. The earth became a mounting terror—a hideous, gyrating maw. . . . They cut his broken body from the wreck.

Let's doff hats—we lesser mortals—to that something which is the mainspring of the ranking test pilot. To the everlasting credit of the men who ride the mustangs, there is always someone ready to chance it next.

Garland Peed, a brilliant pilot of Pennsylvania Scotch extraction, was next elected. In the interim, several important features of the *Bullet* had been repeatedly altered. Test *Bullet* No. 5 was longer in the fuselage. It also carried a wing of different curvature. But, by this time, Washington was discouraged. It declined to send another chief inspector to Colorado Springs.

Peed flew No. 5 to Washington. He put it through all of the paces that a super-cautious staff of experts could suggest. One of them tried the ship. It was acknowledged as an absolutely spin-free airplane.

Sardonic—that Approved Type Certificate. The factory was on its last legs, and those of the nation were weary. The *Bullet* had won an unsavory reputation. That, and the depression, led to receivership, then empty buildings. But it would be hard to make the airport gang believe that the *Bullet* wasn't one of the safest, most inspiring airplanes ever built. It had to be spurred into a spin, and, in passing, it jarred many a designer off the beaten trail. . . .

In the year 1938 one will find the progeny of the *Bullet* doing peerless duty in the civic and military forces of the United States.

END

Aviation, Jr.

(*Continued from page 32*)

Periodic tests are given and by passing them the new member is elevated in rank.

Where possible, cooperative programs are also arranged with school manual training departments and "squadrons" organized in each school district. "Flying cards" and wings are also issued for identification.

In cases where it is impossible to present an aviation program in the schools, arrangements are usually made with various civic organizations

Military organization plans are generally followed in creating junior aviation squadrons, which may be organized by 10 or more boys and girls. The most experienced is then designated commander and a charter is issued for the neighborhood unit. Theater parties are arranged, personal appearance of noted pilots provided, and tours of airports and aircraft factories are made.

All national attendance records for airport tours were broken when the Times Air Cadets visited Chicago's Municipal airport. So great was the turnout that the tours had to be confined to neighborhoods which were allotted specific days. The south side boys and girls visited the field first and more than 10,000 were present. At the conclusion of the tours close to 30,000 boys and girls made the field inspection. The supervisor of the airport, Lt. John Casey, said that he was amazed by the tremendous interest and the all-time record breaking crowds.

END

Soar Your Lightplane

(*Continued from page* 41)

other 160 and the ship had more than half a tank of gas. Although this flight started as late as 6:30 in the evening and lasted an hour and 15 minutes, the engine was used only 35 minutes. At one time, with the prop turning 700 r.p.m., they gained 2,500 feet in four minutes. This utilization of thermals to gain altitude may frequently be of real value. I remember all too well how on a cold, stable and overcast day last spring, Ted Bellak and I took a good half hour to climb a Taylorcraft with full gas tank to only 3,000 feet. This was at Wichita Falls, Texas, during the Soaring Society's level country soaring expedition last spring and we were up to take readings of temperatures and relative humidity at various altitudes.

Shortly before, Harland Ross, the well-known sailplane pilot and designer, had flown this same ship a good deal higher in less than half the time *with the engine idling*. With a variometer installed and with his knowledge of thermal soaring, Harland knew what to do when he encountered a thermal only 400 ft. over the airport. Banking over in a steep but even spiral, he throttled back and continued to climb steadily upward.

In such spiraling, to stay within the sometimes narrow diameter of thermals, it is useful to have a ball bank and an accurate airspeed indicator to do the most efficient flying. Probably the best equipped lightplane in this respect is the *Cub* owned by Capt. Harold H. Brown of Red Bank, New Jersey. Captain Brown has the distinction of being the oldest licensed airplane as well as glider pilot. His ship has an airspeed indicator recording from 20 to 90 m.p.h., a pitch indicator, ball bank and variometer. By frequent experiments in straight gliding as well as soaring, he has not only improved his piloting technique but has also gained a better understanding of his ship's performance. At one time, after having determined his sinking speed in a glide at six feet per second or 360 ft. per minute, he shut off at 6,600 ft. and covered 17 miles before being down to 500 ft. At times his variometer showed no descent at all due to gliding through weak thermals. He considers this sort of gliding rare good sport and says that it has taught him the futility of trying to stretch glides into so-called "graveyard" glides. This past year he had several uneventful dead-stick landings which seem to show that this sort of flying has brought valuable results.

It is unfortunate that the fields of motorless flying and lightplane flying are still rather far apart, when actually gliding with utilities should precede lightplane flying, which in turn should come before high performance soaring with advanced sailplanes. An indication of how leading soaring pilots and instructors feel about this is the incorporation in the Civil Air Regulations, at their suggestion, of the requirement that commercial glider pilots must have a minimum of one hour flying in stalls and spins in a lightplane.

It is my earnest hope that this article may interest many lightplane owners in going out and doing some gliding and soaring with their ships. For those who haven't tried it, I can promise that there are some very real thrills in store for them. If they go about it sensibly they are bound to profit by it in many ways, not the least of which is that it will give them a far more complete understanding and command of the air and make them safer, surer pilots.

END

AVIATION STUDENTS READ "P. A."

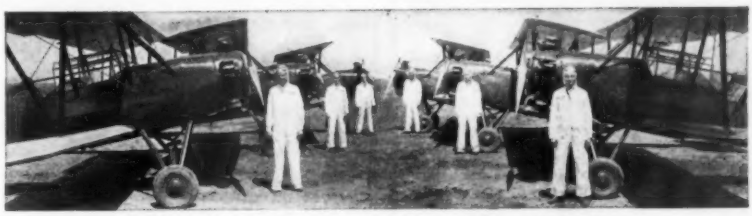
POPULAR AVIATION has always proved most popular among the student bodies of schools and universities— and there is a reason, of course. It is up-to-date, always interesting and at the same time— educational.

A full year's subscription for $2.50, twelve issues that contain more real meat than most textbooks.

POPULAR AVIATION

608 S. Dearborn St. Chicago, Ill.

LINCOLN TRAINED PILOTS *and* MECHANICS



6 of Lincoln's Trainers from its Fleet of 14 Training Planes

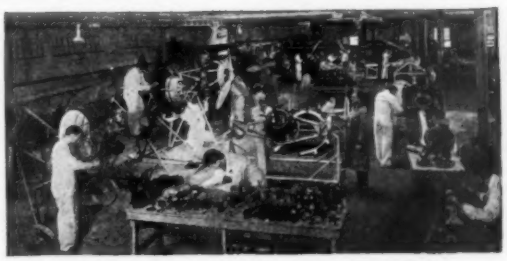
WIN CONFIDENCE and RESPECT WHEREVER THEY GO

As a Lincoln Graduate, you step into Aviation with complete confidence. You KNOW your Lincoln Training has equipped you for a responsible position. For 18 years, Lincoln Graduates have been taking positions in Aviation. Today, they hold good positions with leading Airplane Manufacturers, with Aviation Operators, and with Airlines. They have made good. They have steadily advanced. By the excellence of their service to Aviation, they have won the respect of the industry's leading executives. No wonder then, that Aviation, in selecting its trained personnel, recognizes the Lincoln Trained Man as one well qualified for responsibility.

YOU CAN BE A LINCOLN TRAINED PILOT, MECHANIC OR AERONAUTICAL ENGINEER

Here you can learn to fly fast modern airplanes; to overhaul and rebuild airplanes and airplane motors; assist in the design and actual construction of new advanced type airplanes. Your training at Lincoln prepares you for a good position as Government Rated Pilot or Airplane and Engine Mechanic or as Aeronautical Engineer.

GET LINCOLN TRAINING NOW! Be a Lincoln Graduate . . . take your place with the well trained, well paid men in Aviation. Many a Lincoln Graduate, now successfully employed in Aviation, will tell you the turning point in his career began the day he wrote this Lincoln School for information. You should have our book, "Contact". It tells How Lincoln Trains Men for Aviation. WRITE TODAY for complete information.



Section of one of Lincoln's Airplane Assembly Rooms

LINCOLN AIRPLANE & FLYING SCHOOL

DIVISION OF LINCOLN AERONAUTICAL INSTITUTE, INC.

111 AIRCRAFT BLDG. LINCOLN, NEBRASKA

LEADING AERONAUTICAL ENGINEERS

HAVE PREPARED THESE COURSES FOR YOU TO MEET LATEST DESIGN REQUIREMENTS

Learn

AERO DRAFTING, DESIGN and LAYOUT
AERO STRESS ANALYSIS
AERO ELECTRICAL ENGINEERING

YOU can now enjoy training in specialized aircraft design from courses of outstanding engineers who are employed by major aircraft factories to train limited groups inside the industry

Modern airplane work requires the employment of many experts, each specializing on the solution of one particular problem One of the most important divisions of this work is in the Design and Engineering Departments, which include laying out the first plans for an airplane, working out new theories, seeing them put in production and then proving them in actual flight

Train yourself for one of these better positions Westwood Correspondence School courses contain only essential information and in each course you immediately begin to work out practical aeronautical problems Let us send you, without cost or obligation, a copy of the booklet, "Specialized Application Brings Greater Success." Check the subject you are most interested in on the coupon below

WESTWOOD *Correspondence School*

WESTWOOD CORRESPONDENCE SCHOOL
Village Station, Los Angeles, California

Please send me the booklet, "Specialized Application Brings Greater Success," and full information on the Courses I have checked

- ☐ Aero Drafting
- ☐ Fundamentals of Airplane Design
- ☐ Advanced Layout and Basic Mechanics
- ☐ Aero Stress Analysis
- ☐ Aero Electrical Engineering

NAME..... AGE.....
STREET.....
CITY..... STATE.....
P-1

Japanese Airline

(Continued from page 19)

50 feet altitude. Still, it is amazing how in spite of this they have maintained an accident record (1935-36) of 1.3 percent fatalities per 10,000 flights, and 2.1 percent fatalities per 10,000 hours.

We head due southward from Fukuoka. Our pilot climbs. Five thousand. Ten thousand. Fifteen thousand feet. Perhaps he's worried some wandering squadron of Chinese warplanes might spot us. Our plane is garishly camouflaged. Or perhaps he's merely cautious—wants plenty of visibility so he won't miss Naha, which after all is a pretty small spot in the immensity of the China Sea.

Pretty soon I begin to get hungry. Oh yes, the lunch box. It contains, I find, some slices of raw fish—a Japanese delicacy—rice-balls wrapped in pungent sea-weed, tiny portions of some unidentifiable vegetables, two plums and a little bottle of flat-tasting distilled water for drinking. Admittedly, the food is clean and is most artistically arranged in the box. Chopsticks are provided and even a toothpick completes the service.

The sea is calm below. Occasionally we sight a steamer appearing like some tiny child's toy floating in the park-pond. It's cloudy ahead, and it doesn't look so good. Hope we get into Naha before the stuff closes in. But the stuff does begin to close in on us. We are steadily forced down until nearly five hundred feet, as rain-drops begin to streak the windows.

About 2:30 p.m. we pick up a tiny coral island—tropical green with a halo of pale blue-green shoal water. Another, and still another. And there's Naha ahead. We circle once and shoot the field. Obligingly, the pilot taxis the big Douglas out of the rain and into a huge steel hangar, where the planedoor is opened and we get out to stretch our legs. We've made the 910 km. (565 miles) flight from Fukuoka in three and one-half hours.

Without doubt full information about me had been telegraphed ahead, in the customary Japanese manner of keeping constant tabs on traveling foreigners. (I was the first foreigner, as far as I could learn, to make this flight.) Nevertheless, a fussy little policeman buzzed about me excitedly asking numerous questions—in Japanese, of course, not a word of which I could understand.

I handed him my passport, which meant nothing to him. He couldn't read English. Eventually, one of my fellow passengers spoke up in the most flawless of English.

"May I be of assistance?"

"Why, most certainly. Thanks."

"He merely wants the routine police information: Your name, address, profession, destination, purpose of travel, etc. If you wish, I'll fill up this form for you from your passport."

From our exchange of calling cards—an invariable custom in the Far East—I learned that he was a representative for the American M-G-M studios, traveling to Formosa to explore the potentialities of developing a movie-going public down there.

For that matter, with the possible exception of a petty official or two, every one of my fellow passengers were business men or commercial representatives. The Japanese look to Formosa as a golden field for commercial exploitation and the government does all it can to assist with regulations and subsidies, where necessary, to encourage this.

It was raining lightly, and I had taken it for granted that we would be remaining overnight. But we'd been there barely 20 minutes, time enough for refueling, when we were ushered back to the waiting ship. With some misgivings I took my seat. Still, the pilot must know what he's doing. Perhaps he has a report of good weather not far ahead on our course. At least, I hoped so! The prospect of a 700 km. (434 miles) blind flight ahead was none too pleasant a thought.

But, doggone it if the soup didn't get worse instead of better as we continued Formosa-wards. Soon we were wave-hopping. I mean that almost literally; for we could not have been more than 20 feet above the water for long stretches at a time, until I began to fear that the very next big wave would reach up and grab at a prop tip—and, well, I can swim—but . . .

And would you believe it, that fellow hit Taihoku airport squarely on the nose, and right on schedule, too! Two hours and 40 minutes from Naha.

Fortunately, the clouds had lifted a little as we approached the Formosa coast. We had about 500 feet ceiling there—enough to permit us a reasonable margin of safety in coming in over the city (population about a quarter million) to land on the military airport, right smack in the very midst of squadrons of pursuits and heavy bombers loaded aplenty, lined up ready for a China "egg-laying" expedition. For Taihoku airport, bombed a few months back by Chinese warplanes, is the base for all aerial operations on Canton and South China.

So, perhaps you might guess then what a brass-band reception I—a foreigner, and all foreigners are potential spies—received from the military authorities there. Particularly, when it was discovered that my baggage consisted of little more, figuratively, than a toothbrush and a movie camera.

However, I somehow convinced them that I was no spy come to photograph Formosa's military secrets; that all I wanted was motion pictures of Formosa's "tamed" head-hunters who live up in the mountainous interior.

For the daily round-the-island service there is a Mitsubishi-Airspeed *Envoy*—a fabric-covered, bi-motored, low-wing monoplane. It's a neat looking little craft, "Made in Japan" entirely, except for its two 240 h.p. *Lynx* engines. It has accommodations for a single pilot and six passengers, with seats so small and so nar-

row that I could barely squeeze down into one of them.

This fellow, too, handled a not-too-overpowered commercial plane as if she were a pursuit ship with plenty of horses to spare in the nose. Hardly bothering even to warm up his motor, he gunned her off the ground, banked sharply (it seems a fetish with these boys to bank a ship when taking off, regardless of the course) and headed straight for a range of mountains whose elevation required a steep climbing angle if we were to clear them in time.

He must have changed his mind, however, when we neared them. For he leveled off at least a thousand feet below their tops and began a nerve-shaking snaking in and out as he followed winding valleys. Just what his idea was I couldn't guess. The mountains weren't any too high. Perhaps no more than 5,000 feet or so. But to make matters worse, clouds settled down well over the tops of some of them, at times so low that twice we actually had to wing-over and high-tail back when forward vision was completely obscured.

Eventually, he must have thought better of his foolishness, and coming to a big valley he circled for altitude and then headed for the coast.

Exactly two weeks after the flight I made with this fellow, he cracked up, killing himself and four passengers.

Though photography is strictly forbidden from the air, the Japanese nevertheless cleverly provided even against the "photographic memories" of trained military observers. The west coast of Formosa, facing China, being most heavily fortified, all the curtains in the cabin —which have steel strips along their edges—are drawn and padlocked from the time the ship leaves Taito, whence it swings northward to Heito, Tainan, Taityu and back to Taihoku.

Another memorable flight I made on the J. A. T. lines was from Shanghai to Tokyo and return. This route had not yet been officially opened in August to regular passenger service, though mail is carried on a three-times-weekly schedule. The planes again are Japan-made Douglas DC-2's. They have been carrying only Japanese officials and business men thus far; and as far as I know, I am the first foreigner to have chiseled in on this exclusiveness. Perhaps a good reason for their not caring much to cater to foreigners on this route may be found in a news dispatch in only today's paper that Taziang airport (outskirts of Shanghai) was the scene of a scrap with a band of Chinese guerillas. The Japanese, for the present at least, probably don't relish the responsibility for the safety of foreigners on their hands with their airport in the midst of an area infested with guerillas and planes flying overhead doubtless the target for many a sniping rifle.

The flight takes three hours to Fukuoka, and another three and a half to Tokyo. Seven and one-half hours Shanghai to Tokyo, compared with three days by fastest boat and train combination.

(*Concluded on page* 82)

At Last!

The Inside Dope on WING WALKING PLANE CHANGING

★ For the complete lowdown on stunt flying, you must read "My Experience As A Wing Walker and Parachute Jumper" by Art Starnes, one of America's former ace stunt men who has flown with Roscoe Turner; Dixie Davis; Clyde Pangborn; Bob Shank and A. B. McMullen.

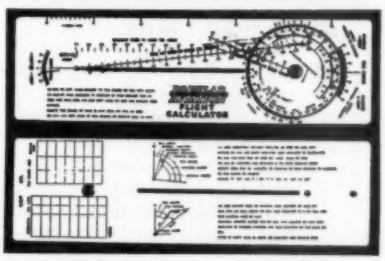
★ Reveals how sensational stunts are done including wing walking; plane changing in midair; automobile to plane change; dive 100 feet into water from plane and the most sensational feat of all time . . . the "swing of death". Illustrated with actual action photos taken for movies and at State Fairs.

★ Send only $1.00 (currency or U. S. money order) today, for this book of thrills. Every page an epic of adventure. Actual experience of one of aviation's foremost stuntmen. He tells you how he did it. Send $1.00 today before our supply of this wonderful book is exhausted. Do it now!

SEND ONLY $1.00

ART STARNES
Box 321, Calumet City, Illinois

A New Supply of POPULAR AVIATION FLIGHT CALCULATORS



. . . has just arrived. Our original supply has been exhausted but POPULAR AVIATION readers requested us to manufacture more so we have ordered and received an additional 200. This supply may not last long so fill out the coupon and mail it. This is worth while doing now.

FREE!

Notice! Flight Calculators can be obtained only with a 2-year renewal or new subscription.

POPULAR AVIATION
608 S. Dearborn St.
Chicago, Ill.

Sirs:

Enclosed is $4.00. Please enter or extend my subscription for two years and send me a Flight Calculator free. (If this is a renewal check here ☐). Start with the ..... issue.

NAME.....ADDRESS.....CITY.....

STATE.....What airplanes do you fly?.....Pilot's License.....

This offer good only in the United States, its possessions, and Canada.

»YOU CAN DO IT as well as the other fellow. Get out your old camera and get hold of some new ideas.

» The obvious source for such ideas is
POPULAR PHOTOGRAPHY
THE LEADING PHOTOGRAPHIC MAGAZINE

In readable and enjoyable articles it tells you what film to use and what to photograph; how to light and pose your subject; how to make good portrait and landscape shots—in short, how to become a successful amateur photographer.

» POPULAR PHOTOGRAPHY replaces dry instruction by brilliant, easily understandable feature stories that are truly educational without ever becoming boring. That is the key to its phenomenal success.

ON SALE AT ALL NEWSSTANDS AND PHOTO DEALERS

Popular Photography

POPULAR PHOTOGRAPHY
608 S. Dearborn St., Chicago, Ill.
Please enter my subscription at the special rate of $1 (Foreign $1.50) for 6 months. Enclosed is $1.

Name.....City.....

Address.....State.....

Japanese Airline

(*Continued from page* 81)

Cost: Yen 150, which is even less than first class boat-and-train combination.

A number of 21-passenger Douglas DC-3's were already on their way from America for the Fukuoka-Shanghai service, which, it was hoped, would be formally inaugurated some time last October. The route may in all probability be extended to Nanking. Meanwhile, five ten-passenger Lockheeds are now being assembled in Japan to augument the most-traveled Tokyo-Fukuoka "express" service.

J. A. T. is the only major commercial air service in Japan proper. Though privately operated, it is nevertheless heavily subsidized by the government. Here are the official subsidy figures (one yen equals $0.844 in American money):

1932-33 (actual figures)..	Yen 2,374,949
1933-34 (actual figures)..	1,368,886
1934-35 (actual figures)..	954,042
1935-36 (actual figures)..	840,283
1936-37 (budget figures) .	1,449,769
1937-38 (budget figures) .	3,790,000

Closely affiliated with the J. A. T. is the Manchuria Aviation Company, a joint Japanese - Manchou investment which was founded in October, 1932, with a capital of Yen 3,850,000. Due to the rather unsettled conditions obtaining in the country immediately after the "Manchuria Incident," coupled with the comparatively poor transportation systems serving the widely-separated trade and industrial centers of this backward country, the M. A. C. answered a pressing need for rapid transportation to keep pace with the intense modernization.

Today the M. A. C. operates nearly 10,000 Km. (6,214 miles) along 13 aerial routes, and is extending its service steadily, linking more and more of the far-flung, heretofore isolated, border trade marts with the capital. M. A. C. flying stock ranges from a three-passenger Beechcraft C-17E (280 h.p. Wright *Whirlwind* engine) to a Japan-made six-passenger Nakajima-Fokker *Super Universal* (420 h.p. Nakajima-Bristol *Jupiter* engine) both landplane and seaplane, and their pride, a designed-and-made-in-Japan eight-passenger all-metal Nakajima AT (two 460 h.p. Kotobuki engines)—something like our Boeing transport in appearance.

Another J. A. T. affiliate is the Sino-Japanese Huitung Aviation Company which was established in November, 1936, for the operation of through air service between North China and Manchuria. It is capitalized at Yuan 4,400,000 (the Yuan, or Chinese dollar, is about par with the Japanese Yen—and at the official exchange is equal to about 29 cents American money). The H. A. C., with its head office in Tientsin, operates four principal routes, viz.: Tientsin - Dairen, Tientsin - Chinchow, Tientsin - Kalgan, and Tientsin - Jehol City. The Tientsin-Dairen section makes direct connections with J. A. T., bringing Tokyo within a single day's flight from commercial Tientsin and scenic Pieping.

END

'Tin'-Skinned Airplanes

(*Continued from page* 48)

manufacture of airplanes besides occupying a vital part in our daily life.

When Charles Martin Hall, just out of Oberlin College, discovered the process for the electrolytic production of aluminum some fifty years ago, he paved the way for this industry.

Once in pure aluminum form, formed into ingots weighing roughly 165 pounds each, this metal is passed to the rolling mill, where they are remelted and the alloy materials, making the metal suitable for airplane construction, are added. Elements commonly employed in making the aluminum aircraft alloys are copper, silicon, magnesium and manganese and, to some extent, zinc, chromium and nickel. The alloying elements are added to the molten aluminum, which is cast into form ingots suitable for further fabrication.

In the production of sheet, a rectangular ingot is rolled hot to form a slab. The slab in turn is cold rolled to the desired thickness. It is then ready for heat treatment and aging.

Alloy 24ST, most common of the aluminum alloys used in aircraft, contains 4.4 per cent copper, 0.5 per cent manganese and 1.5 per cent magnesium. If it is heat treated at an elevated temperature, its strength is materially increased. After being held at the heat treating temperature for the proper length of time, it is quenched in cold water. Such treatment insures that a maximum amount of the alloying elements is put into solid solution in the aluminum.

After heat treatment, alloy 24ST hardens or ages at room temperature until, in about four days, it reaches its maximum strength. From the plate mill the sheets go to the finishing mill where, under huge rollers and presses, it is pulled down to the proper thickness and width for airplane use.

Next the trimmers and polishers get the metal in hand and it is trimmed to the desired size for shipment to the airplane factories. It is packed for shipping in wooden cases, 18 sheets to a case and daily there are several carloads leaving the Alcoa plant for airplane factories throughout the country.

This aluminum sheet, as we have said before, has a good resistance to corrosion. However, for even greater resistance Alclad sheet has been developed. This is the outer covering now in use over the alloy on all-metal planes. This Alclad consists of a strong core (usually 24ST), which is alloyed and integral with a coating of high purity aluminum. As a result Alclad combines high strength with exceptional resistance to corrosive influence.

In the shipping shed of the Alcoa plant there are huge signs next to the doors leading to the railroad sidings, with the names of the leading aircraft manufacturers of the nation painted thereon. Metal consigned to each particular factory is placed under the factory name to which it is consigned, labeled and then shipped. A few of the aircraft manufacturers getting aluminum from Alcoa are Douglas, North American, Curtiss-Wright and Lockheed.

While the above description has been of the aluminum sheet used for the outer covering of the planes themselves, many of the interior struts and braces and framework of the planes also are made from aluminum. Generally these are manufactured from aluminum alloy castings, which are produced in sand, die and permanent molds. Forgings of aluminum alloys are also important in present day airplane construction.

END

"Swing" Is Dangerous

(*Continued from page* 53)

the beats of the "A" or "N" signals or between the double station announcements. The result, to the pilot, might be utter confusion until he landed on beams Nos. 1 or 3 and used a normal cone and beam. This looks so obvious to the reader of this article when he's riding in his easy chair and flying by this diagram, at an altitude of two feet off the living room floor. When one is in or over the soup the situation can become extremely puzzling. Once the puzzle has been solved by guesswork or by trial and error the situation loses its seriousness, but the longer it remains unsolved the more puzzled the pilot becomes, detracting from his normal ability to think clearly and act coolly.

Not all the erratic behavior of the beams can be laid to topography or weather, or sunspots or what-have-you. Some of it is due to ground antennae and transmitters, and airplane antennae and receivers.

The author once wrote on the evils of physical obstructions to flying near airports ("We Need a Law," POPULAR AVIATION, March, 1938), and advocated laws enabling the removal by legal means of such physical obstructions; but would not go so far in this case as to advocate the removal of power lines, railroads or mountains just to keep the beams in the straight and not-too-narrow path. For instance, a railroad near Nashville played tricks with the beam which tended to skew off and run parallel to the tracks. Engineering research, different location or design of the transmitting station, would be infinitely cheaper and more satisfactory than the shifting of the railroad lines.

It is not the intention of this article to delve too deeply into the "Why's?" of erratic beam behavior, but to lead the average pilot away from the dangerous habit of trusting too implicitly on the beam, without the added use of the experience of others with a particular beam he might be using, the marker beacons, cross readings on intercepting beams, the radio compass, dead reckoning and any or all other possible means of checking on his instrument flying. In the Link trainer or under the hood of an instrument training plane you can make a mistake and laugh it off or wait for the controller or the check pilot to set you right via the interphone. Flying through the soup is something else again.

END

Now Get the Pick of the Pack in These

25

19—Supermarine

CLEVELAND DELUXE CHRISTMAS GIFTS

65—Lockheed Electra

Every Kit Super Complete with All Colors, Cements, Etc.—Every Kit Bears the C. D. "Red Spot" of Approval

JUST in time for your own Christmas gifts and those of your most particular friends—these 25 hand-picked Kits from Cleveland's more-than-a-hundred unrivalled models. Every Kit a super deluxe Kit in contents (absolutely nothing missing) and every one deluxe in value and *authentic realism!* Just the Kits for you real modelbuilders who "love detail". And remember—absolutely complete—nothing else needed. So avoid disappointment, pick out the ones you want for yourself and friends RIGHT NOW!

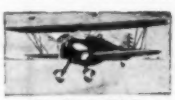
27—Doolittle's G-B

1—Gr. Lks. Sp. Trainer

17—Bayles' Gee-Bee

All These C-D DeLuxe Kits Are Super-Complete

DLSF-1	Great Lakes Trainer	$2.00
DLSF-2	'29 Travel Air Mys. Ship	2.50
DLSF-17	'31 Bayles Gee-Bee Racer	1.95
DLSF-19	Supermarine S6-B	2.25
DLSF-21	Curtiss Hawk P6-E	3.00
DLSF-27	'32 Doolittle's Racer	1.95
DLSF-35	Boeing Transport	6.25
DLSF-40	Famous Aeronca Sport	1.75
DLSF-42	Howard Racer "Ike"	1.25
DLSF-43	Army Douglas 0-38 Obs.	3.50
DLSF-45	Martin Bomber MB-2	6.50
DLSF-46	'30 Laird "Solution"	2.00
DLSF-47	'33 Wedell's Own Racer	2.50



21—Hawk P6-E

43—Douglas 0-38 Obs.

DLSF-48	'34 Turner's Wedell-Wm's	2.50
DLSF-49	F11C-2 Navy Goshawk	3.50
DLSF-52	Howard's "Mr. Mulligan"	2.50
DLSF-60	Army P26-A Fighter	3.00
DLSF-61	Seversky P-35 Fighter	3.00
DLSF-63	'36 French Caudron	2.00
DLSF-71	'37 Folkert's Special	2.00
DLSF-72	'38 Turner-Laird Racer	2.50
DLD-35	Boeing Transport	2.75
DLD-45	Martin Bomber-2	2.75
DLD-55	Douglas Transport	3.25
DLD-65	Lockheed Electra	2.75

Get C-D's Great New Catalog No. 5!

Hot off the press—crammed full of thousands of items—Aircraft, Ships, R. R's, Racing Autos, Parts, Cameras, Microscopes, Gas Engines, etc., etc. Send 10c at once for your copy.

If your dealer cannot supply you, order direct by check or M.O. (cash at own risk). Outside U.S. add 10% extra.

DEALERS: Get some real model sales. Write for details.

CLEVELAND MODEL & SUPPLY CO., INC.

Quality Hobby Equipment—Since 1914

4508-C2 Lorain Avenue, Cleveland, Ohio, U. S. A.

Now Only $5.00

REAL ENGINE VALUE

Over 7,000 GHQ Gas Engine kits have been sold at $8.50. Now is your chance to buy the New Improved Kit for $5.00. Absolutely complete with coil, plug, etc. Send only $1. Shipped Exp. Coll. for balance same day. Catalog 3c

1/3 H.P. For Boats and Planes

All Parts Guaranteed

A screwdriver is the only tool needed. Average assembly time 30 minutes.

GHQ MOTORS, 854P East 149 St., New York

Subscribe to Popular Aviation

As Little as $1.50 a day for a Spacious Room on MICHIGAN AVENUE

CHICAGO

Here's a hotel value for you. A large spacious room right on Michigan Avenue at the edge of the Loop, with every comfort and luxury at a rate that is surprisingly low.

George H. Mink, *Manager*

WITH PRIVATE BATH from $2.50

WITHOUT PRIVATE BATH from $1.50

AUDITORIUM HOTEL

MICHIGAN AVENUE AT CONGRESS STREET

Our Airlines Are Safe

(*Continued from page 26*)

receiver systems, with standby source of electric energy for their use, and another standby in the form of radio direction finders—all of which will permit of maximum navigating ability by the pilot so that he will be more confident that he is where he thinks he is, and is better equipped to conquer the elements.

The aircraft and its propellers have also been equipped with deicers that make it practical to pass through light ice and to some extent what is known as moderate ice—but not heavy ice. Anti-static devices have recently been very successful in light static and even moderate static conditions, but not heavy static conditions. Flight practices do not permit flight into anticipated or unfavorable static or icing conditions. So much for what has been done with standbys for the aircraft, its equipment, crew and fuel supply.

The airlines of this country have set the world standard for safety and technical efficiency in air transportation on the basis of passenger miles flown. We have made definite progress in providing the crew with the essentials of safety. But how are we to make still more safe and efficient use of what has been provided to the crew so that they can further avoid the emergency situations that confront them en route.

Alternate airports have been provided; they serve as standbys, in the event an emergency situation requires their use.

Alternate routes are used as standbys when the weather on the regular route is not flyable.

Alternate flight levels are provided as standbys in case the regular level is not desirable and/or where there is less exposure to the elements, thereby providing maximum safety. During the past year the trend has been to these upper level airways, which definitely limited the exposure of collision with the terrain—a big stride in the trend of safety.

Instrument approach systems are soon to be in use as standbys to the present successful landing down-through procedures.

A standby member of the flight crew has been provided for. He is known as the dispatcher. He is well qualified. He remains on the ground to assist and advise with the crew before and during the flight on all matters pertaining to the conditions that may affect the safety of the flight.

Air traffic control is now provided as a standby for the purpose of minimizing the possibility of collision between aircraft. This is another step forward in the safety trend of air transportation. Since the early days of air transportation, airline management has sought to develop the machine to such perfection that less would be required or expected of the man. Remarkable developments of the machine and its equipment have been accomplished for greater margins of safety. But unfortunately in the past these improvements in safety were sometimes used to fly tougher weather with less safety instead of the usual weather more safely.

We depend, like other forms of transportation, more upon the man than the machine. Piloting in this country has reached a high state of perfection, and with many standbys to safety that are alternatives for emergency situations when they arise. It may now be said that it is no longer a case of "man versus machine", but a case of "man and machine" versus the few very well known problems we are aggressively working on. The cooperative effort of the C. A. A., the airlines, N. A. C. A., military forces, factories and Weather Bureau will soon see the degree of perfection that we seek.

Two of our well-known problems are heavy static and heavy ice, so until our machines are equipped to conquer these hazards, our policies must be to avoid these conditions by keeping the machine out of them. That is a matter for the pilot and dispatcher.

The airlines have provided the pilot with every facility at their command. The airlines work with the pilots in keeping abreast of every facility, practice and advancement in the science of flying. We have, to a very large measure, accomplished this end, as indicated by the development of relatively safe transportation, but our goal is to improve this safety record further so a public, slow in accepting any new form of transportation, will accept it as they do older forms of transportation.

The public wants and loves to travel. When they do, they are always in a hurry. Speed is the major commodity that we have to sell—it's a natural for us.

Therefore, the day is coming when *fear or fare* will no longer be a question in the public mind. The question then, will be, "Why don't we get more ships?" That day is not far off.

END

WANTED: 7 FEARLESS ENGINEERS

Young men with love for electrical and mechanical work, who are not afraid of isolation. Must be willing to leave country, never to return. Great opportunity to develop mastery of huge machines. This position is for lifetime. Once accepted, no opportunity to turn back. Apply room 36, 18 W. Morgan Ave., City.

WARNER VAN LORNE presents the most amazing engineering story ever told. Follow Dick Barrow and his six courageous comrades into a land of mystery and giant machines, sworn to the collossal job of rescuing a great nation from disaster.

Plus six other great tales of science and many absorbing articles in the

FEBRUARY ISSUE

AMAZING STORIES

Now on Sale at All Newsstands

SAINT LOUIS' FINEST

★ At the Center of Things.
★ Quiet and Dignified Atmosphere.
★ Comfortable, Home-Like Rooms
★ Four Famous Restaurants.
★ Adjoining Garage
★ Rates from $3.00

THE HOTEL CORONADO

PRESTON J. BRADSHAW MANAGING DIRECTOR

PHOTOS! SPECIAL PHOTOS!

When you want unusual AIRPLANE PICTURES—go to a firm that has been taking them professionally for newspapers and magazines for years. Build a really worthwhile collection of beautiful aviation photos at small cost: 4x5, glossy prints for only 10c each. Everything from flight and formation views, action and detail shots—military, commercial, sports, experimental, etc. Publications pay the original cost so that we can offer them for only a dime each. Once you see them you'll be sold. Keep up with aviation progress as we add new pictures weekly. A 3c stamp brings our free list No. 1 of 150 "ace" shots.

RUDY ARNOLD PHOTOS
Room 272, Floyd Bennett Airport, Brooklyn, N. Y.

BIG MONEY Assembling NEW MEAD KI-YAK at Home!

MEAD'S complete cut-to-fit KI-YAK Kit easily assembled for pleasure or profit! Can't sink. Portable. Seaworthy. Light . . . Fast. Highest quality. Low cost. 3 models 20 lbs. to 45 open a new world of sport for you both in sailing, paddling. Also 2 portable Outboard Models. Rush 10c for illustrated folder. $6 Paddle now given with "CK" KI-Yak—if you hurry!

MEAD GLIDERS
15 S. Market
Dept. E-19
CHICAGO

Teachers!

AVIATION is perhaps the fastest growing field of industry and education today. It has made the world think in new terms. Schools throughout the country are using POPULAR AVIATION Magazine as a text book in class and club.

IF you wish information regarding our Bulk School Plan and rates, fill in the coupon and mail it to our School Department. Incidentally, this is worth while doing now.

POPULAR AVIATION PA
608 South Dearborn Street
Chicago, Illinois
Please send me your Bulk School Plan and rates.

NAME..... STREET.....
CITY..... STATE.....
SCHOOL .....

Cupid Gets Streamlined

(*Continued from page 22*)

Stimson even got out a Cupid-bedecked folder advertising the service, and an attractive embossed "Prepaid Exchange Order — Reno All-Expense Wedding" addressed to the United Air Lines agent in Reno assuring prompt service for the altar-bound pair. The original is given to the bride, presumably to be framed with the wedding certificate . . .

Western Air Express picked Las Vegas and published a folder entitled "1¾ Hours to Paradise," decorated with a Wild West Cupid astride an airliner prominently displaying the WAE Indian head emblem.

"Fly to Las Vegas for your wedding," it says. "Board a luxurious Western Air Express airliner at Los Angeles and be whisked away to the land of romance. . . . Las Vegas, Nevada, where amid the spirit of the old West, this most hospitable desert mecca offers a fascinating and unforgettable setting for the bride and groom . . . "

Follows a list of expenses totaling $28, which added to the cost of air fares ("Ask any WAE office or agent about special fares") gives the honeymooners the cost of their trip.

And then, for ". . . any WAE office or agent," Western Air issued Traffic Bulletin No. 30 carrying everything from a digest of Nevada marriage laws to the difference in cost between a rose and gardenia corsage! The County Clerk, it reveals, will bring the license book to the airport cactus garden if the necessary information as to ages, marriage records, etc., of the contracting parties is wired ahead. Included in the bulletin is a list of day and night telephone numbers of the County Clerk and his deputies, Judges, Justices of the Peace and ministers from Catholic priests to Mormon Bishops, together with a reminder that Trip 24, departing Los Angeles at 7 p. m., is fast becoming known as the *Honeymoon Flyer*.

American Airlines has an even more elaborate set-up at Phoenix, two hours out from Los Angeles. There, built in cooperation with the Chamber of Commerce, is an airport wedding altar featuring a bronze plaque whereon the names of couples married before it are inscribed. And that isn't all—if the wedding party will give American half a chance, there'll be cowboys and Indians standing around.

The cost—including Indians—is $115. That covers, if you please, outward passage on an evening plane, the wedding, early evening hotel accommodations from which you can go out and "see the town" and—tsk! tsk!—a sleeper plane berth homeward.

So far no airline has advertised co-pilots who are also ordained ministers, but there *is* a case in the courts of California wherein a Los Angeles man and woman seek to have their wedding declared legal . . .

They were married *above* the three-mile limit by the "Captain" of a United Air Lines airliner! END

SEWELL-FORDYCE COMPANY'S
Sensational Offer
OF ONLY 5000 GENUINE
ELGIN De Lux Challenger
ELECTRIC DRY SHAVER

$1.98

Nationally Advertised $15.00 Electric Dry Shaver

This New Elgin CHALLENGER Is
TAKING THE COUNTRY BY STORM

1. Gives as close a shave as a blade Razor.
2. Cuts long and short hairs with equal facility.
3. Gives a fast shave without pulling.
4. Gives a good, clean, close shave with absolutely no skin irritation.
5. No radio interference. Play the radio and shave at the same time.
6. Lifetime motor, No rotating parts. Requires no oiling.
7. Makes shaving a pleasure, not a nuisance.

SEWELL-FORDYCE Company
192 Market Street, Newark, N. J.

Enclosed please find $..... for which send me ..... New Elgin Dry Shavers, with guarantee certificate, instructions and cleaner. Guaranteed for one year.

Name .....
Address .....
City..... State.....

DON'T GUESS . . .
KNOW!!

- AIRPLANES
- ENGINES
- NAVIGATION
- METEOROLOGY
- RULES and
- REGULATIONS

"PLANE FUNDAMENTALS for FLYER'S LICENSE"
ILLUSTRATED
Just Published
by FORMER U. S. NAVY PILOT

A Handy, Pocket-sized Volume Packed with Aviation Facts. All Questions for license Requirements Answered with Illustrations. Essential to every Pilot-Student, Amateur, Private, Solo, Limited Commercial and Commercial Pilot seeking higher rating.

NOW $1.50

MAIL COUPON TODAY TO:
Power Publishing Co.,
40 Clinton St., Newark, N. J.

Sir: Please forward me ..... copies of "Plane Fundamentals for Flyer's License."
I will pay the postman on delivery ☐
I am enclosing—Money Order ☐ Check ☐

Name .....
Address .....
City..... State.....

PHOTO ENLARGER $5.94

Money back guarantee
A REAL Photo Enlarger that does fine work. Focuses automatically. Also COPIES and has a Contact Printer and Retouching Table. Interesting circular free. Only $5.94 complete. Lens included.
IDEAL-H, 122 East 25th St., NewYork

AVIATION - RADIO
LET RADIO BE YOUR STEPPING STONE TO A CAREER IN AVIATION
Our radio telephone third class license manual qualifies you for government license as radio operator in aviation, aeronautical, police and mobile radio telephone stations. No code required. One dollar postpaid.
INLAND WIRELESS, 1234 S. Wabash, Chicago

"GETTING A JOB IN AVIATION"
By Carl Norcross, Ph.D.
374 PAGES 5½x8
ILLUSTRATED
A FRANK AND PRACTICAL GUIDE TO EMPLOYMENT POSSIBILITIES IN AVIATION

Answers your questions about: Basic Jobs, duties and responsibilities set forth, entrance qualifications, salaries, possibilities of promotion, number of jobs available, advantages and disadvantages of each job, jobs which require special training, where to go for training, cost of training, types of traning to be avoided, where to go to find a job, who to see, and what to emphasize in talking with employment managers.

So, if you're really anxious about a career in aviation, GET THIS BOOK—it will give you honest answers to honest questions about aeronautical jobs. Send $2.50 to: Book Dept., POPULAR AVIATION, 608 S. Dearborn St., Chicago.

Safety in Spins

(*Continued from page 59*)

wing span. S is the wing area. L_t is the tail length as given above. And S_{vm} is the vertical tail area as given in the first formula. As there is no set formula or rule for finding the exact amount of tail area is necessary for stability and an addi- is not necessarily correct. However though, it is well to follow them until flight tests prove otherwise.

Listed here are a few general conditions concerning spins.

High wing loading makes recovery more difficult. This will probably not worry the average home-builder for he usually uses a wing loading of from six to ten pounds which is comparatively low.

The center of gravity location is of major importance, for if it is too far to the rear it will cause the tail to drop at the moment of the stall. The result is a flat spin. Recovery is very difficult as it is almost impossible to get the nose down to pick up flying speed.

Variation in the slope of the resultant air forces relative to a right angle to the wing chord at varying angles of attack is one of the major sources of spinning couples. As this variation is greater with high lift wing sections than with low lift wing sections a ship using a high lift wing section will spin easier and faster than it would if a low lift wing had been used.

Recovery at low altitude is easier than at high altitude due to the difference in atmospheric pressure.

All wing sections have a rotative couple at very high angles of attack. That is, below the stall the wing resists being rolled because the wing moving downward has a greater angle of attack and consequently more lift which brings it right back up. But beyond the stall a higher angle of attack gives less lift so that the wing that is moving downward has less lift than the one moving upward so the tendency is to complete the roll.

END

Man Under the Hood

(*Continued from page 49*)

officer is not supposed to "talk shop" even with a friend in, for instance, the infantry . . .

* * *

As a matter of fact, this "secrecy" business on the part of the **Army** and **Navy** (particularly the latter) is getting a bit too absurd for realism . . . actually, both services have few secrets they can keep from us very long . . . we have many friends—and even readers of POPULAR AVIATION who work in the many aircraft plants—who can and will supply us with information concerning "secret" projects . . . fact of the matter is that the military services have pounced on recent spy scares as an opportunity to boot the lowly civilian off the premises . . . to the extent, in fact, that some of the "rabble" already have approached their Congressmen . . .

END

COLT 45 Cal. "FRONTIER" MODEL $1.45

Basswood construction kit with working plans, machined barrel, cylinder and all necessary hardware.

COLT 45 Cal. "FRONTIER" model kit, 4¾" barrel..$1.45
COLT 45 Cal. "FRONTIER" model kit, 5½" barrel. 1.55
COLT 45 Cal. "FRONTIER" model kit, 7" barrel. 1.70
COLT 45 Cal. Automatic Pistol kit..... 1.00
Full scale Thompson Sub Machine Gun model kit.. 3.00
SAVAGE Cal. 32 Auto. Pistol kit, machined barrel.. .75
LUGER Auto. Pistol with 4" machined barrel..... 1.75
LUGER Auto. Pistol with 6" machined barrel..... 1.90
COLT 25 Cal. Automatic Pistol kit..... .50

These beautiful kits are complete in every detail and made of the best basswood. All parts are cut to shape and require only a short time to finish. Postpaid in U. S. A.
GUN MODEL CO.
Dept. K-61, 2908 N. Nordica Ave., Chicago, Ill.

PHOTOGRAPHS
1938 National Air Race Entrants
Bendix Greve and Thompson Winners
Other Racing and Commercial Aircraft Past and Present Contact and Enlarged Sizes - - - Send 10c for list.
Charge for list refunded on first order
Wm. Yeager's
AIRCRAFT PHOTO SERVICE
5116 Clark Avenue Dept. PA-1 Cleveland, Ohio

Other men have read and profited by our free books "Patent Protection" and "Selling an Invention." Fully explain many interesting points to inventors and illustrate important mechanical principles. With books we also send free "Evidence of Invention" form. Prompt service, reasonable fees, deferred payments. Write immediately to: Victor J. Evans & Co., Registered Patent Attorneys, 117-A, Victor Building, Washington, D. C.

PATENT YOUR IDEA

STUDENT FLYERS
OF AMERICA, INC.
Expert flying instruction by Gov. approved instructors. New flying equipment. Ideal planes for winter flying. Free Ground School. Comfortable club room. Excellent airport. Cost within the reach of everyone. No down payment. No obligation to continue. Credit extended. Opportunities to earn expenses. Write for FREE interesting pamphlet No. 4.
Hangar No. 3, Floyd Bennett Field, Brooklyn, N. Y.

Prepare for your Mechanic's License
issued by the Department of Commerce. Immediately available are authentic questions with answers and accurate diagrams—for airplane mechanics $1.25 per set; for engine mechanics $1.25 per set; both sets $2.00 POSTPAID.
An Ideal Christmas Gift
Meyer Engineering, Box-8-F Hempstead, N. Y.

RADIO ENGINEERING, broadcasting, aviation and police radio, servicing, marine and Morse telegraphy taught thoroughly. Nine months' engineering course equivalent to three years' college radio work. School established 1874. All expenses low. Catalog free.
DODGE'S INSTITUTE, Dodd St., Valparaiso, Ind.

NEW AUTOMATIC ADDER, $3.75
Makes adding easy. It's accurate, quick, durable and easily operated. Capacity 8 columns. Saves time, brain work and errors. 85,000 pleased owners. Fully guaranteed. Price $3.75 delivered. Agents wanted.
J. H. BASSETT & CO.
Dept. 46, Box 302, Altadena, Calif.

See it REBUILT BY WOODSTOCK BUILDER
Winner... Most World's School Contests—
EASY TERMS—FREE TRIAL
WRITE FOR LITERATURE DEPT. B-6
WOODSTOCK TYPEWRITER CO., WOODSTOCK, ILL.

"P. A." for Christmas
POPULAR AVIATION is an outstanding gift for an airminded friend. A beautiful Christmas card with the donor's greetings will accompany each annual subscription. 1-Subscription $2.50; 2-Subscriptions $4.00; 3-Subscriptions $6.00.
Christmas Gift Dept.,
POPULAR AVIATION
608 S. Dearborn St., Chicago, Ill.

Gas Model

(*Continued from page 66*)

is constructed of 1/16" O. D. soft iron wire, celluloid and thin cardboard. The forward part of cockpit has a removable hood so that new batteries may be installed as well as the model's balance place by four small screws passing through cardboard into stringers. A simple way to construct the hood coverings is to fit the celluloid over the framework and cover it with cardboard which has cutout sections to represent metal bands. Paint these cardboard pieces before cementing to celluloid.

Step No. 5.

Constructing the landing gear requires a little extra patience, as this is the vital part of the ship upon its landings. The landing gear struts are made from 1/16" O. D. spring steel wire. These are bent to the proper shape and bound together at the various junctions by means of heavy thread and cement. To gain the shock absorbing effect, the two inner struts slide into holes in the bottom of fuselage which are in turn fastened to rubber bands in the side of body. A third strut may or may not be installed as this would not make the landing gear absolutely true to scale. But on the other hand we advise it, as the model will make some very hard landings and this extra strut will serve its purpose well.

Step No. 6.

Covering the model will necessitate the best of your skill for this is where most model builders fall down. A good grade of bamboo paper is used in the covering of this model; it is applied with ordinary airplane cement diluted with 50 per cent thinner. In covering the fuselage, cover in long strips from front to rear, one stringer space at a time. This will give a much neater covering job. In covering the wing it is necessary to attach the bamboo paper to every rib on the bottom side only. This is to gain the proper airfoil section. On the top side of wing this is not necessary. The space between fuselage and rib "A" on the underside is covered with bamboo paper. The space between rib "A" and fuselage on the top side is covered with a strip of thin card. board. This strip is not cemented into place until the model has been completely doped in clear colors.

In shrinking the bamboo paper, apply water over the entire surface with any spraying device. If this is not available, use a brush—but special measures should be taken so as to prevent the bamboo paper from tearing as this is easily done when same becomes wet. After the paper has become thoroughly dry apply two or three coats of clear dope with a light sanding between each coat. Colors may be next applied.

Step No. 7.

Such details as battery rack, installation of motor and all details pertaining to marking, etc., are clearly shown on the plan and accompanying photographs. We might add here that by carrying out all details a much nicer model will be had.

Step No. 8.

We believe most every model builder is thoroughly familiar on how to balance his model. In testing your model for the proper gliding angle, do so over some tall weeds or grass to prevent any injury to the ship. Making sure that it glides to the ground on an even keel, you are now ready to test it under power. Tabs on the wings and rudder are for any adjustments you may make in balancing your model. If your model is not equipped with a timer, we advise you to put only a very small amount of gas in the tank to give the model a very short flight. Take every possible precaution in balancing and test hopping your model before you give it its initial flight. A lot of good common sense plus a great deal of patience at this point will be well worth your while.

END

Red Cross

(*Continued from page 56*)

all were hard at work alongside the Red Cross on the Atlantic coast in that area's recent crisis in which a tornado wreaked heavy damage and cost hundreds of lives. One of the hardest-hit sections was Boston. The only major airline operating into that city is American Airlines but, when that company found itself swamped in its efforts to rush doctors, nurses and medical supplies to the stricken area, huge airliners of United Airlines, TWA and Eastern Airlines immediately were speeding to the scene. The unselfish cooperation of these airlines with the Red Cross only reflected the heroic role those aviation companies played in the disastrous floods of 1937.

At the present time Red Cross officials are cooperating with the various states along the Mississippi and Ohio Rivers in drawing up preparedness plans to cover operations in cases of future disaster. In all these plans the services of aviation are envisioned. Through the various state governments, members of the National Guard are assigned definite duties in cases of disaster. Flying units from these organizations will have their duties cut out for them. Rescue observation and reconnaissance, transport of personnel and supplies, flights to determine the extent of disaster and the initial requirements for emergency relief, as well as other duties will fall to the members of these squadrons.

END

DO YOU LIKE RADIO

DOES THE FUTURE OF TELEVISION INTEREST YOU?

You men anxious to make good in radio and related industries want the true facts,—you want to know about employment opportunities and requirements. National Schools,—a million-dollar trade school,—will supply you with a sincerely honest statement of facts on what you should do to get into the profitable radio industry. No exaggerations,—no misstatements. Mail coupon today. ¶Send for your free copy. Real facts on radio employment requirements. ¶You need real experience. National offers complete training with modern equipment.

Send for your free copy

NATIONAL SCHOOLS
Los Angeles

Request for FREE BOOK of DETAILS

NATIONAL SCHOOLS,
Dept. 1-PA 4000 S. Figueroa St., Los Angeles, Calif.

NAME _____ Age _____

ADDRESS _____

CITY _____ STATE _____

Do Your XMAS HINTING Early!

FOR THAT MEGOW Gas-Powered Model

The experienced model builder demands a Megow kit because of special features and advantages which make it easy for him to turn out a really swell job! That's why Megow gas-powered models are among the champions in every prominent contest . . . and why all finished Megow models attract so much attention!

FLYING QUAKER
Span 7 ft. 3 full-size plans, 28" x 34". Cut-out propeller blank. Special Balsa wood, steel wire, sheet aluminum, celluloid and necessary materials. Streamlined wheels and many other features.
$5.95 plus 20c post.

All Megow rubber-powered flying models, 25c and over, have realistic Megow Motor Hum Device, and when possible, turned nose cowling. Carved Hulls feature Megow model ships.

Send 5c for complete catalog of airplanes, ships, HO-Gauge Railroads, ready-made parts and supplies, 100 pages, illustrated.

BASSETT'S Cardinal 3.95 plus 20c post.
Megow's new, light-weight 48" crackup-proof gas-powered model. Ready-to-use propeller, die-cut parts. Spec. rubber wheels. Uses any small ⅝" stroke and bore motor.

QUAKER FLASH
The world's champion. 2 full-size 28" x 34" plans. 5 photos. Cut-out propeller, special quality supplies. Uses any model airplane motor. Wings removable, easy to carry. 3½" puncture-proof wheels. Span 67".
4.95 plus 20c post.

MEGOW'S
Dept. PA., Howard & Oxford Sts., Philadelphia, Pa.
or 217 N. Desplaines St., Chicago, Ill.
Great Western Merc. Co., 718 Mission St., San Francisco, Cal.

Classified Advertising

RATE: 15c PER WORD MINIMUM: 10 WORDS

AIRPLANES FOR SALE

USED AEROPLANES $150.00 up, terms $20.00 monthly. 25c for large list. Aero Guide, Box 25, Flint, Michigan.

OX5 WACO 10, Millerized, scintilla mag., duals, spare prop, identified, ex. flying condition. $300. Walter Engle, Dowagiac, Michigan.

AIRPLANE FOR SALE: Pietenpol, factory job. $295. F. O. B. Vancouver, B. C. 523 St. Clair West, Toronto.

LICENSED PORTERFIELD LeBlond 65 powered, $1,325. Total 65. New Aug. 18, 1938. Francis Jensen, St. Francis, Kan.

TWO PLACE—half complete. $25.00 Mourgalas, 9520 Parnell, Chicago, Illinois.

OVER 1000 AIRPLANES, $40 up. OX-5 jobs $100 up flyaway. Terms. Complete catalog 25c. Used Aircraft Directory, Athens, Ohio.

OX5 SWALLOW, three place, identified and flying, $285.00. H. C. Mushrush, De Witt, Arkansas.

'38 SPORT CUB—air speed, perfect condition. A bargain at $1,175. Will finance. Hogan Flying Service, Municipal Airport, Scottsbluff, Nebraska.

58 PLANES; $75-$800; $76-$850 up; also 50 wanteds; repairables; flyables; licensed. Extensive solicitation, advertising keeps up these figures constantly. International Aeroplane Guide, 25c postpaid, Port Huron, Michigan.

AIRPLANE PARTS & PLANS

WANTED: Motors or parts, Szekeley, Salmson Continental. Box 143, Sacramento, California.

WANTED: Motor, 35 to 45 H. P. Reasonable. Kotan, 10744 Perry, Chicago, Ill.

NEW HEATH Motor and Propeller, 70 h. p. Aircooled. $85.00. Tomack, 2221 Hunting Park Ave., Philadelphia, Pa.

SALE: Aeronca Motor with hardwood prop. $65.00. Joe Trtek, Seapoose, Ore.

PROPELLERS: All types, including three blade airliners, for sleds, more attractive, greater efficiency and maneuverability. Special introductory prices. List free. Universal Aircraft Company, Ft. Worth, Texas.

AIRPLANE SUPPLIES

BROTHER CAN YOU SPARE A DIME? —OR TWO? Two new Catalogues are ready. One dime brings you either one. Two dimes bring both. Specify whether you want Aviator's Personal Equipment Catalogue or Aeronautical Supply Catalogue, or both. Karl Ort, 667 W. Poplar St., York, Pa.

USED AIRPLANES

Bought • Sold • Exchanged

One regular classified advertiser says: "Our experience has indicated that POPULAR AVIATION must have the highest interest of any other aviation magazine in comparison with circulation rating."

signed: Mechanics Universal Aviation Service Co.

If you're planning on buying a plane, disposing of one, or making a trade, let P. A. classified ads do it for you. It's easier when you use the magazine with the largest circulation in the field! Write: Classified Mgr., POPULAR AVIATION, 608 S. Dearborn St., Chicago.

PARACHUTES

PARACHUTES, buy, sell, describe fully. Thompson Bros. Balloon & Parachute Co., Aurora, Illinois. Established 1903.

BRASS, steel, aluminum, stainless steel, gears, supplies, etc., in small quantities. Catalog 10c. Hobby Supply House, Box 2014, Pittsburgh, Pa.

FOR SALE OR TRADE

DELTA drill press, motor, Precision tools, cutters, cash. Trade for 2 place licensable light plane less motor. John Rys, 180 Park St., Lawrence, Mass.

FOR SALE OR TRADE: Gipsy Moth for closed ship or late automobile. George Petron, Pierre, So. Dakota.

TRADE OX American Eagle for auto or plane. Box 423, Kermit, W. Virginia.

INSTRUCTION

AVIATION APPRENTICES — Training for entering Aviation as Apprentices—write immediately, enclosing stamp. Mechanix Universal Aviation Service, Wayne County Airport, Dept. B21, Detroit, Michigan.

LEARN to fly Free. Folder, dime. Corrigan, Box 391-F, Hempstead, N. Y.

HOW I LEARNED, a free aviation trade. Tells you how. Booklet 50c. George Hudson, Jr., Hotel Greenville, Greenville, S. C.

MISCELLANEOUS

PROPELLERS for Sleds, Airplanes, Catalog 5c. Banks Propellers, Love Field, Dallas, Texas.

WANTED—Original poems, songs, for immediate consideration. Send poems to Columbian Music Publishers, Ltd., Dept. K51, Toronto, Can.

YOUNG MAN 21 desires job apprentice airplane mechanic for room, board, 7 years' auto experience. Tony Alek, Plumsteadville, Pa.

FOR SALE: Champion Baby Cyclone Gas Model, $18. Write for details. Raymond Davies, Corydon, Iowa.

SWAP Books, Magazines, Courses. Jones, Box 30, Schertz, Texas.

BEAUTIFUL 15½ inch model of the Spirit of St. Louis. Completely assembled. Guaranteed. $1.00 C.O.D. Leonard Erbert, Ellis, Kansas.

WARTIME AIRPHOTOS—Amazing 5x 7's, 20c ea. Robert McLarren, 720 S. Normandie, Los Angeles, California.

PATENTS

PATENTS—Low cost. Book and advice free. L. F. Randolph, Dept. 372, Washington, D. C.

SPECIAL RATE TO READERS

(non-commercial)

10 words for 50c—extra words 15c each.

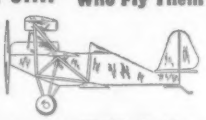
Note: Name and address is part of ad and should be included in word count, when figuring cost.

BUYERS' DIRECTORY

RATES: - - - - - - - - $7.00 PER INCH

AIRPLANES FOR SALE

AMERICAN FLEA SHIP Ask the Boys Who Fly Them



Pilot Ormand says his FLEA out performs a $1500.00 ship, does not stall, has everything. Easy payment plan $12.50 down. Send 25c illustrated information.

Universal Aircraft Company, Inc., Ft. Worth, Texas

AERO BLUE BOOK

Get your copy of the 1939 Blue Book of Aviation now! Gives specifications of planes and motors 1926-39, inclusive—1939 mode's illustrated; valuable points in choosing a flying school; appraised value of many used planes; lists of manufacturers, etc. Priceless to aviation enthusiasts, students, engineers, flyers. Send $1.00 currency or money order (no C.O.D. please)

AIRCRAFT DISTRIBUTING CO. Div. 1-PA, 1480 Arcade Bldg., St. Louis, Missouri. $1.00 Postpaid

BOOKS

STUNT

Exact method for every Stunt from simple wing-overs to outside loops. By Lieut. Joe Mackey, America's finest stunt pilot. Fully illustrated, complete. Price $1.00. Details sent on request.

THE AIRCRAFT DIRECTORY Athens, Ohio

MODELS

Actual "Goshawk" Model

FINISHED MODELS Modern and wartime airplane models built to order. Pine construction; lacquered and rigged properly. Wingspans, 3" to 7". Smooth and glossy finish guaranteed. Name your model. Price—$1.75 each. Models having 12 inch wing spans will be built for $6.50 each; any model desired. No COD orders. No Stamps. Please print your name and address to avoid delay. Satisfaction guaranteed.

MUELLER BROS. 28 Peach Street Buffalo, N. Y.

Aviation Books

Complete Stock of Books on All Aviation Subjects.

Send for Catalog.

GOODHEART WILLCOX

2009 So. Michigan Ave., 1-PA, Chicago, Ill.

PROPELLERS

PROPELLER SPECIALS. Stainless steel. Double tipped on genuine linen base. Selected dark mahogany imported propeller stock. Save 300% and buy the finest propeller possible to produce. Order from this ad.

4' Harley & Indian Motors	$ 9.95
4'6" Heath Henderson	12.60
5' for all 35 h.p. motors	14.85
5½' Fords, Lawrence, Anzani	16.65
6' Fords, Chev., 45-50 h.p. motors	18.00

We have lower priced propellers 98c up. From factory direct to you. Literature free. Universal Aircraft Co., Ft. Worth, Texas.

I Flew for a Week

(*Continued from page 28*)

plished fact, gave the pilots on this latest trip their weather information at regular intervals, served as a check at all times on our position and even, when we were approaching Billings, Montana, brought me personally the unwelcome information that I was expected to make a speech at the air show when we landed there. That was the only spot on the trip where they had turned out cowboys to herd the planes around, but they did have them on duty at this airport with its Bill Hart statue—as a protection to the crowds.

The ham sandwich I mentioned in that earliest air journey of mine was succeeded on this latest one by a series of some of the best meals I've ever eaten anywhere. They ranged all the way from box lunches served by the co-pilots on some of the smaller lines—but really elegant box lunches such as a girl would put up to take to a box social—to course dinners on tables covered with linen and set with silver and china and served by a delightful young stewardess. The average cost of such meals, I knew, is close to a dollar a passenger—only the airlines pay it and present them gratis. Great care is taken now to study dietetic values and much research has gone into discovering which foods can take altitude successfully.

From a standpoint of effectively resisting fatigue on so strenuous a trip, the comfort of the planes themselves was of first importance. I traveled in three types on the 13 different lines—Douglases, Lockheeds and Boeings. The Douglases were both the older D-2 and the more modern DC-3 and DST's. The Lockheeds were both the *Electras* and the newer, very fast "14's." The Boeings were the refurbished 247D's. The smaller planes are excellent equipment for short runs and in spite of rather cramped cabin space, ride very well.

In the DC-3's and DST's, the greatest comfort is achieved, of course, because there is more room to move around. No one who has not flown can imagine the casualness and relaxed friendliness of traveling above cloud levels in ships of this kind. In the sleepers, there is a sort of other-worldly routine about the night. The stewardesses are so efficient in making up the berths and in thinking of so many little services for you, that you are badly spoiled by the end of a trip. Ovaltine for a nightcap and breakfast in bed if you want it—at 10,000 or 12,000 feet altitude. Forsooth! Who wouldn't fly?

Day after day and night after night, at the 67 airports in which I made stops, the routine of service went on. It made no difference on which airline I was flying at the moment. There is an uncommonly healthy pride among our Americans who have a hand in this aviation business. It doesn't seem to matter very much whether you're the president of the line or just a grease monkey. You've got a feel of being a part of something bigger than you are—something you want to go all the way out for. It gets you into the way you walk, the way you snap to attention for passengers, the way you overhaul an engine or clean a cabin.

A special log, written for me by the pilots of a ship on one of the smaller lines, sums it up neatly. "In all the country you're going to see," they wrote, "We think you'll like this trip best. It's really the most beautiful route in the United States."

That was really a fact—the beauty of the scenery was outstanding, even though the line was small.

That was what a Week came to mean before this particular one was over—pride in a job well done. But the kind of pride that is never satisfied until the job can be done still better.

END

Statement of the ownership, management, circulation, etc., required by the Acts of Congress of August 24, 1912, and March 3, 1933, of Popular Aviation, published monthly at Chicago, Ill., for January, 1939. State of Illinois, County of Cook. ss. Before me, a notary public in and for the State and county aforesaid, personally appeared A. T. Pul'en, who, having been duly sworn according to law, deposes and says that he is the business manager of the Popular Aviation and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit: 1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, W. B. Ziff, 608 S. Dearborn St., Chicago, Ill.; Editor, B. G. Davis, 608 S. Dearborn St., Chicago, Ill.; Managing Editor, J. B. Rathbun, 608 S. Dearborn St., Chicago, Ill.; Business Manager, A. T. Pullen, 608 S. Dearborn St., Chicago, Ill. 2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its names and address, as well as those of each individual member, must be given.) Ziff-Davis Publishing Company, 608 S. Dearborn St., Chicago, Ill.; W. B. Ziff Co., 608 S. Dearborn St., Chicago, Ill.; W. B. Ziff, 608 S. Dearborn St., Chicago, Ill.; B. G. Davis, 608 S. Dearborn St., Chicago, Ill. 3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None. 4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him. 5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is ..... (This information is required from daily publications only.) A. T. Pullen, Business Manager. (Signature of editor, publisher, business manager, or owner.)

Sworn to and subscribed before me this 21st day of September, 1938.

[Seal.] M. Gnass, Notary Public. (My commission expires February 26, 1940.)

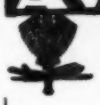
BE A RADIO EXPERT

Learn at Home—Make Good Money

Many men I trained now make $30, $50, $75 a week in Radio. Many started making $5, $10, $15 a week extra in spare time soon after enrolling. Illustrated 64-page book points out Radio's many opportunities, also how I train you at home to be a Radio Expert through my practical 50-50 method. Television training is included. Money Back Agreement given. Mail coupon today. Get book FREE.

J. E. SMITH, President, Dept. 9AY7,
National Radio Institute, Washington, D. C.
Send me, without obligation, your 64-page book "Rich Rewards in Radio" FREE. (Please write plainly.)
AGE.....
NAME .....
ADDRESS .....
CITY..... STATE.....

AVIATION



AVIATION NEEDS MEN. Permanent jobs at highest pay for mechanics, meteorologists, pilots, ground men. Our thorough, interesting training plan prepares you to enter the big field of Aviation as a paid

APPRENTICE

If you want to get into Aviation with the least expense, write immediately enclosing stamp. No experience required.

Mechanix Universal Aviation Service Company
WAYNE COUNTY AIRPORT Box 857 Dept. B **Detroit, Mich.**

AIR-COOLED FORD A

Uses regular block. No water. No machining. Air-cooled finned aluminum head and other castings do the trick. Castings easily attached. Light weight. Low cost. Complete simple instructions, illustrated circular 50c.
ELECTRIC MANUFACTURING, ST. PAUL, MINN.

AIRMEN-RADIOMEN!

Every airways radio station needs a frequency standard. It is a necessity for lining up airplane receivers. Read full details on how to build this valuable instrument in the article:

"An Inexpensive Frequency Standard"

★

Are You Up On Television?

Television is at last approaching the home. New York starts regular programs, and soon there should be Coast-to-Coast schedules for everyone. Follow the latest developments in this newest radio field.

THESE AND MANY OTHER FEATURES WRITTEN SO THAT YOU CAN UNDERSTAND THEM WILL BE FOUND IT THE BIG

JANUARY ISSUE

RADIO NEWS

Now on Sale at All Newsstands, 25c

PREPARES FOR ANY CERTIFICATE:

Aeronautics

by Hilton F. Lusk, formerly Dean, Boeing School of Aeronautics. 420 pages, 175 illustrations, $3.25.

This is a complete ground school course in handy book form. It clearly and thoroughly explains all the subjects you need to understand to pass the written part of the government examinations for a certificate as an airplane pilot in any of the grades, or as an airplane or engine mechanic. No one who masters this book will have any difficulty in answering any question that may be asked in the examination. The 15 chapters explain simply and clearly just what you need to know about Flight Principles; Airplane Construction, Operation; Engine Principles, Construction, Operation; Propellers; Blind Flying and Engine Instruments; Maps; Piloting; Dead Reckoning; Avigation Instruments, Equipment; Meteorology.

A COMPLETE ENGINE COURSE:

Aircraft Engine Mechanics Manual

by C. J. Moors, Chief Instructor, Department of Mechanics, Air Corps Technical School, U. S. Army. 511 pages, 189 illustrations, $4.50.

Covers same ground as course given enlisted mechanics of Army Air Corps, with addition of much data on equipment used only on commercial planes. Deals thoroughly with all kinds of aircraft engines and their accessories. Mr. Moors gives all needed data on construction and operation, supplies full instructions for proper maintenance, and shows you exactly how to go about making repairs and adjustments.

ENTIRELY WITHOUT MATHEMATICS:

Principles of Aerodynamics

by Max M. Munk, Ph.D., Dr. Eng., formerly in charge of Aerodynamics Research for the N.A.C.A. 252 pages, 62 illustrations, $3.00.

Written in simple language without any mathematical detail, this book is a reliable guide to a logical understanding of the principles of aerodynamics. Dr. Munk is a world-renowned authority—no aircraft is designed without some direct or indirect use of theories and methods originated by him. His remarkable book makes crystal clear the basic ideas underlying many of the most complex design formulas. Its 7 parts include: General Aerodynamics. Wing Section Theory. Wing Theory, Experimental Aerodynamics, Propeller Theory. Applied Aerodynamics.

Fill in, tear out, and mail

Sent on 5 Days' Approval

The Ronald Press Company

Dept. M276, 15 East 26th St., New York

Send me the books checked below. Within five days after their receipt I will either return them or send payment in full at the prices shown, plus a few cents for delivery. (We pay delivery charges when cash accompanies order—same return privilege.)

- ☐ Simmons, Air Piloting..... $3.00
- ☐ Lusk, Aeronautics 3.25
- ☐ Munk, Principles of Aerodynamics..... 3.00
- ☐ Moors, Engine Mechanics Manual..... 4.50

Name .....
Home
Address .....

City..... State*.....

☐ Employed by,
☐ or Reference .....

Address .....

* Outside continental U. S. and Canada, cash plus 25c per book for shipping.

☐ Check here if you wish our catalog of Aeronautic Publications, FREE. M-276

WILL HELP YOU TO PASS THE OFFICIAL TESTS FOR ANY PILOT RATING

Now Ready—on Primary and Advanced Training

"Air Piloting Manual of Flight Instruction"

By VIRGIL SIMMONS

Formerly Flying Instructor at Boeing School of Aeronautics and in U. S. Army and Navy Air Services

300 Pages, 75 Illustrations, Price $3.00

WRITTEN to help its users meet the latest government requirements—the Civil Air Regulations issued May 31, 1938—this new book supplies in detail the flight training instructions needed by beginners and also by pilots, already proficient, who aspire to attain higher grades. In addition it will be helpful to flying instructors and to pilots who wish to obtain the instructor rating. It brings you the cream of what the author has learned in training hundreds of pilots in his twenty years of continuous experience in both the Army and Navy Air Services and as a flying instructor and director of flight training in leading commercial flying schools. It is designed for use as a text in primary and advanced courses given at flying schools. It is also designed as a practical guide for pilots who wish to correct faults and attain greater proficiency in precision flying.

AIR PILOTING supplies a detailed system of instruction from first solo to blind flying. All flight test maneuvers now required for the various pilot certificates and flying ratings are completely analyzed and explained, with complete diagrams of maneuvers to illustrate every detail of their execution and make them clear and easily understood. Radio range layout, methods of orientation, private flyer's use of radio, are all thoroughly covered.

In addition to full instructions on primary essentials, the manual contains much information on advanced flying techniques, including exhibition aerobatics. Its descriptions of average faults and explanations of their causes will help you increase your own skill.

PARTICULARLY important are lists of specimen questions—totaling 377—taken from official examinations for all grades of pilot certificates, including airline flying instructor. Answers that have been accepted as correct accompany each question.

OUTLINE OF CONTENTS

General Considerations. Advice to beginners. Pilot ratings and official requirements. Safety precautions. Ten Commandments of safe flying.

Airplane and Controls. Parts of airplane described; functions described. Wings. Fuselage. Engine and propeller. Control surfaces. Control parts. Landing gear. Pilot's equipment.

Primary Flight Training. Outline of procedure followed by typical schools. Detailed description of first eleven lessons with explanation of maneuvers taught.

Piloting an Airplane. Primary flight training maneuvers: Straight and level flying. Climb and glide. Gentle turns. Turns in glide. Climbing turns. The take-off. Taxying. Landing. Medium banks. Steep banks. Faults made in banks. Stalls. Spins. Base-line glide approach.

Civil Air Regulations. Selected air traffic rules which must be thoroughly mastered by student pilots preparing for government examinations.

Solo Pilot Flight Course. Procedure before and after solo. Factors to observe in primary 8's 1 and 2. Advantages of the base-line glide approach. Summary of flight test requirements.

Private Pilot Flight Course. Shallow, circular, steep eights. Triangulation spirals. The 180°, 360°, 1080° spirals; vital factors to keep in mind. Practicing stalls, with and without power. Primary and advanced spins. Procedure for the 720° vertical bank. Crosswind take-offs and landings. Forward and slideslips; slipping turn.

Limited-Commercial Pilot Course. Requirement for higher degree of proficiency in same maneuvers as those in private pilot's flight test. Restrictions and privileges of the limited-commercial pilot rating.

Commercial Pilot Flight Course. Summary of maneuvers in flight test. Possible additions made by inspectors to usual flight test routine. Precision maneuvers recommended for developing highest skill in handling plane near ground, from predetermined exact altitudes. Night flying. How to execute the split-S turn; the chandelle; skyline 8; half roll; barrel roll; loops; falling leaf.

Cross-Country Flying. Map reading. How to lay out a cross-country course. Facilities provided by Federal airways system. Preparation for cross-country flying. A typical cross-country flight with detailed explanation of pilot's procedure.

Airways Radio. Radio-range orientation described and illustrated—90° method, parallel bisector method. Radio compass navigation; fundamental principles explained. How to obtain bearings. Establishing fixes. Magnetic compass deviation. How to prepare a calibration chart of radio compass deviations. "Homing." Combined radio-range and radio-compass navigation. Charts.

Instrument Flying and Rating. Maneuvers that must be performed, solely by instrument, in practical flight test. How radio skill must be demonstrated. Airplane, Link Trainer instruction methods. Flight Plan. Typical practice flight procedure.

Flying Instructor Rating. Requirements for special competency rating. Latitude given examining inspector to assure himself of candidate's qualifications. Summary of flying school rules and sequence of training maneuvers for primary and advanced students with which prospective instructor is expected to be thoroughly familiar.

Meteorology. Condensed selection of definitions and explanations pertaining to meteorology within scope of examinations given for all ratings above solo pilot.

Miscellaneous. Handling plane having 3-wheel landing gear. Exhibition aerobatics at low altitude: Inverted figure 8. Cuban 8's Nos. 1, 2, 3.

THE RONALD PRESS COMPANY, Publishers

15 East 26th Street ESTABLISHED 1900 New York, N. Y.